

THE TAXONOMY OF *CAREX* SECTION *SCIRPINAE*
(CYPERACEAE)

DEBRA A. DUNLOP

Biology Department, New England College, Henniker, NH 03242

GARRETT E. CROW

Department of Plant Biology, University of New Hampshire,
Durham, NH 03824

ABSTRACT. Section *Scirpinae*, as treated herein, forms a cohesive group of dioecious, unispicate sedges with pubescent perigynia, chromosome numbers of $n = 31$, and similar leaf anatomy, and possesses a high degree of interfertility between subspecies based on hand-pollinations. Taxa in this section are distributed primarily in North America. Taxonomic problems in the group have been related to the lack of a comprehensive monographic treatment, incomplete descriptions, and a lack of an understanding of the patterns of variation in morphological characters across a wide geographic range. Based on evidence from a previous study using morphology, chromosome numbers, leaf anatomy and surface structure, achene and perigynium micro-morphology, interbreeding relationships, ecology, and distributions, five taxa are recognized. The section, as treated here, consists of *C. scirpoidea*, with four subspecies (ssp. *scirpoidea*, ssp. *convoluta*, ssp. *pseudoscirpoidea*, and ssp. *stenochlaena*), and *C. curatorum*. Two taxa, *C. gigas* and *C. scabriuscula*, have been excluded.

Key Words: Cyperaceae, *Carex*, *Carex curatorum*, *Carex gigas*, *Carex scabriuscula*, *Carex* section *Scirpinae*, *Carex scirpoidea*, *Carex scirpoidea* ssp. *scirpoidea*, ssp. *convoluta*, ssp. *pseudoscirpoidea*, and ssp. *stenochlaena*, systematics, taxonomy

The taxonomic treatment of *Carex* section *Scirpinae* presented here recognizes *C. scirpoidea* Michx. ssp. *scirpoidea*, ssp. *convoluta* (Kükenthal) Dunlop, ssp. *pseudoscirpoidea* (Rydberg) Dunlop, ssp. *stenochlaena* (Holm) Löve and Löve, and *C. curatorum* Stacey. The subspecies of *C. scirpoidea* are geographically based ecotypes that differ morphologically in only a few characters. Two taxa, *C. gigas* (Holm) Mackenzie and *C. scabriuscula* Mackenzie, previously assigned to the section, have been excluded based on inconsistencies in characters that distinguish the section (Dunlop 1990).

This taxonomic treatment is based on the results of a biosystematic study of the section *Scirpinae* (Dunlop 1990). A detailed

analysis of variation in characters focused on morphology, anatomy, achene and perigynium micromorphology, chromosome number, ecology, breeding relationships, and distribution patterns. Specimens were borrowed from 48 herbaria and collected from 30 field sites. At each field site, four to ten plants of each gender were collected and grown in the University of New Hampshire greenhouse for the chromosome analysis, breeding system observations, and crossing experiments. In addition, 17 analyses were conducted on field-site soil samples.

Variation was assessed in a macromorphological study consisting of 139 individuals using 69 qualitative and quantitative characters. A numerical analysis was conducted on a subset of these individuals using Principle Components Analysis.

Achene micromorphology was examined in 62 specimens, resulting in distinctions at the specific level but not the subspecific level (Dunlop 1990). In addition, micromorphological features of 42 perigynia were studied. *Carex scirpoidea* and *C. curatorum* have hirsute to villous perigynia with long hairs distributed over the entire adaxial and abaxial surfaces, or occasionally on the upper one-half to two-thirds surface. This contrasts with *C. gigas* and *C. scabriuscula*, which have sparsely pubescent perigynia with short hairs on the top third of the perigynia.

Internal foliar anatomy and surface features were examined in transverse sections and epidermal peels. The leaves of the subspecies of *Carex scirpoidea* are anatomically indistinguishable except for the very narrow, flanged, V-shaped leaves of ssp. *convoluta*. The presence of hairs on the adaxial leaf surfaces of *C. curatorum* distinguish it from *C. scirpoidea*.

Thirty reliable chromosome counts were made from greenhouse-grown plants; photographic vouchers are presented in Dunlop (1990). The subspecies of *Carex scirpoidea* have counts of $n = 31$, whereas *C. gigas* and *C. scabriuscula* have counts of $n = 29$. Based on the reported aneuploid series in *Carex*, it would not be unexpected to find $n = 29$ as part of a series with $n = 31$. Thus, this lower number alone would not be justification to exclude the two previously mentioned taxa from the group. However, when correlated with morphological, anatomical, and ecological data, chromosome data strengthen the evidence to remove *C. gigas* and *C. scabriuscula* from the section (Dunlop 1990).

Observations on greenhouse-grown plants (Dunlop 1990) show the dioecious breeding system to be stable in *Carex scirpoidea*

subspecies and *C. curatorum*. Slight variation occurs whereby one to two staminate flowers may appear among the pistillate flowers on a pistillate spike, or one to three pistillate flowers may occur at the base of a staminate spike or in the axil of the involucre bract. The breeding system of *C. gigas* and *C. scabriuscula* is more variable as plants may often possess small androgynous spikes.

Interbreeding relationships were examined using experimental hand-crosses with greenhouse-grown plants. Subspecies of *Carex scirpoidea*, although rarely sympatric, are highly interfertile in the greenhouse (Dunlop 1990).

TAXONOMIC HISTORY

Tuckerman (1843) first applied the epithet *Scirpinae* to one of nine groups of sedges of unspecified rank under section *Psyllophorae*. He distinguished the *Scirpinae* as a group of plants that were almost always dioecious with red-brown, pubescent perigynia. His concept of the *Scirpinae* included *C. scirpoidea* (= *C. scirpina* Tuckerman) and *C. drummondiana* Dew. Later, in a treatment of North American carices, Bailey (1887) took a broad view and assigned *C. scirpoidea* to section *Sphaeridiophorae* Drejer, which included subsections *Filifolia* Tuckerman and *Montanae* Fries. In the same year, Pax (1887) placed *C. scirpoidea* in section *Dioicae* Fries in subsection *Scirpoideae*. Kükenthal (1909) adopted Tuckerman's concept of the *Scirpinae* group, excluded *C. drummondiana*, and established section *Scirpinae* in subgenus *Primocarex*. The sectional name is validly published by Kükenthal.

The subgeneric placement of the section *Scirpinae* has varied depending on an author's view of whether the unispicate condition was primitive or derived, or of the evolutionary significance of certain characters (Krechetowich 1935; Kükenthal 1909; Nelmes 1951; Reznicek 1990). Kükenthal (1909) placed the section in subgenus *Primocarex*, as he viewed the unispicate condition as primitive. In a thorough discussion, Reznicek (1990) summarizes the subgeneric history of *Carex* and, as generally agreed, recognizes three subgenera: *Carex*, *Indocarex*, and *Vignea*. Subgenus *Primocarex* is considered artificial and therefore not recognized due to the heterogeneity of the unispicate *Carex*. Relationships of section *Scirpinae* to other sections remains uncertain.

Since 1803, when Michaux described *Carex scirpoidea*, the taxon on which the section is based, nine additional taxa have been recognized by various authors. Rydberg (1900) recognized *C. pseudoscirpoidea* Rydb. as a distinct species differing from eastern *C. scirpoidea* in being more robust plants with scales shorter than the perigynia. Then, Holm (1904) described two new varieties of *C. scirpoidea*: var. *stenochlaena* Holm and var. *gigas* Holm. Two additional taxa, *C. scabriuscula* Mack. and *C. scirpiformis* Mack., were recognized and described by Mackenzie (1908) in a treatment of *C. scirpoidea* and allies. Kükenthal (1909) recognized two additional varieties of *C. scirpoidea*, var. *convoluta* Kük. and var. *europaea* Kük. Later, Stacey (1937) described *C. curatorum* Stacey, and Hermann (1957) described *C. athabascensis* Hermann.

All but two of the above mentioned taxa (*Carex athabascensis* and *C. scabriuscula*) have been treated by different authors at the specific level or as varieties of *C. scirpoidea*. In his worldwide monograph, Kükenthal (1909) took a narrow view of the section and recognized only one species with five infraspecific taxa (var. *scirpoidea*, var. *europaea*, var. *convoluta*, var. *stenochlaena*, and var. *gigas*). In contrast, in a treatment of North American carices, Mackenzie (1935) recognized six distinct species.

In addition to differing taxonomic viewpoints, various interpretations in terminology, primarily in the use of the words aphyllopodic and phyllopodic, have further complicated our understanding of the systematics of this group. Furthermore, species descriptions have been based primarily on pistillate plants; staminate material often had not been described, nor even observed, for some taxa. Until this study, patterns of variation in morphological characters had not been described across the full geographic range, and information on endemic taxa was sparse.

TAXONOMIC CRITERIA

This study follows the criteria and definitions of species and infraspecific taxa outlined by Standley (1985) and Crins and Ball (1989) for *Carex*. Species are defined as groups of populations that are distinguished by discontinuities in a suite of morphological and anatomical characters. Additionally, species have a unique geographic distribution or ecology, and are reproductively

isolated through either genetic incompatibilities, geographic or ecological isolation, or differences in phenology.

The rank of subspecies has been applied here to the well-defined subunits of the wide-ranging *Carex scirpoidea*. Each subspecies is distinguished by vegetative or reproductive characters, a distinct distribution, and a unique habitat. Four subspecies are recognized, two of which have been designated recently (Dunlop 1997).

TAXONOMIC TREATMENT

Carex L. section *Scirpinae* (Tuckerm.) Kükenthal in Engler, Pflanzenreich 38 (IV:20): 81. 1909. TYPE: *Carex scirpoidea* Michx. *Scirpinae* Tuckerman, Enum. Meth. Caricum Quarrunum, 1843. *Scirpoideae* Pax in Engler and Prantl, Nat. Pflanzenfamilien 2(2): 123. 1887, as subsection. *Trysanolepis* V. Krecz. in Komarov, Flora of the USSR 3: 243. 1935.

Cespitose perennials with red-brown, lignescent roots. Rhizomes either short or elongate with internodes 1–2 cm long. Culms arising from current year shoots (lacking the withered persistent leaf bases of the previous year) or from shoots of the previous year, triangular, scabrous on the angles, height exceeding the length of the leaves. Pistillate culms 5–94 cm tall. Staminate culms 3–74 cm tall. Leaves of the rhizome and culm base reduced to sheaths, lacking blades. Leaves of the flowering shoot attenuate, adaxial surface glabrous or pubescent, scabrous with marginal prickles. Vegetative leaves similar to leaves of the flowering shoot; mouth of the leaf sheaths concave, entire to erose; sheath front membranous, scabrous, white to tan; dorsal surfaces coriaceous, glabrous, pale green to red-brown; ligules semicircular to triangular, tan to red-brown, ciliate. Inflorescences unisexual, rarely bisexual, then only with few staminate flowers interspersed in the pistillate spike or 1–2 perigynia in the axils of the involucrel bract at the base of a staminate spike. Inflorescences unispicate, very rarely with a small lateral sessile spike of the same sex, erect or on lax culms, linear to clavate, densely flowered to loosely-flowered at the base. Involucrel bracts usually present, sometimes single, foliaceous or scale-like, shorter than or equal to the inflorescence, attenuate, inserted below spike. Perigynia ovate to lanceolate, narrower than, equal to or as wide as the subtending scale, tightly or loosely enveloping the achene, pale

green, tawny, red-brown to purple-black, hirsute to villose with white-golden brown hairs. Achenes brown, trigonous, 1–2.5 mm long, 0.8–1.5 mm wide, rarely with a short stipe, filling the full length and width of the perigynia or filling only one $\frac{1}{3}$ to $\frac{1}{2}$ the length and width. Stigmas 3. Rachilla absent or present. Anthers 1.5–3.5 mm long. Chromosome $n = 31$.

KEY TO *CAREX* SECTION *SCIRPINA*E

1. Achenes not filling the full length or width of the perigynia, occupying $\frac{1}{3}$ the width of the perigynia such that the sides of the perigynia are compressed; adaxial leaf surfaces sparsely pilose with fine white hairs; plants of low elevations in n. Arizona and s. Utah 2. *C. curatorum*
1. Achenes filling the perigynia or at least all but the upper $\frac{1}{3}$; adaxial leaf surfaces glabrous; plants widely distributed especially in calcareous soils in arctic and alpine habitats, often on cliffs and ledges (2)
2. Culms arising from shoots of the previous year such that withered leaf bases of the previous year persist, sheathing the base of the culm; scale leaves absent at the base of the culm; leaves of the flowering shoot clustered, diverging from one region of the shoot axis ca. 10–20 mm above the rhizome
 1b. *C. scirpoidea* ssp. *pseudoscirpoidea*
2. Culms arising from shoots of the current year, lacking withered leaf bases from the previous year; scale leaves present, conspicuous at base of the culm, red-brown (anthocyanic); leaves of the flowering shoot diverging from intervals scattered along the shoot axis (3)
3. Perigynia lanceolate to oblanceolate, (2.8) 3–4 (5) mm long, greater than 2.5 times as long as wide; culms usually lax causing the spikes to droop
 1d. *C. scirpoidea* ssp. *stenochlaena*
3. Perigynia ovate to obovate, (1.8) 2–2.5 (3) long, less than 2.5 times as long as wide; culms stiff, spikes erect (4)
4. Widest leaves of the flowering culm of pistillate plants more than 1.5 mm wide, leaves flat or widely V-shaped in cross-section
 1a. *C. scirpoidea* ssp. *scirpoidea*

4. Widest leaves of the flowering culm of pistillate plants less than 1.5 mm wide, leaves mostly convolute or narrowly V-shaped in cross-section 1c. *C. scirpoidea* ssp. *convoluta*

1. ***Carex scirpoidea*** Michx. Fl. Bor. Am. 2: 271. 1803.

- 1a. ***Carex scirpoidea*** Michx. ssp. ***scirpoidea***, *C. michauxii* Schwein., Ann. Lyceum Nat. Hist. N.Y. 1: 64. 1824 (based on *C. scirpoidea*). *C. scirpina* Tuckerman, Enum. Meth. Caricum Quarundum 8. 1843 (spelling change, based on *C. scirpoidea*). TYPE: CANADA. Boreal regions, *Michaux s.n.* (HOLOTYPE: P, microfiche P!, photo MT!).

C. wormskiolidiana Hornemann, Fl. Dan. 9: 6 pl. 1528. 1816. TYPE: GREENLAND. Mallenefield (Plate 1528).

C. scirpoidea forma *basigyna* Lange, Consp. Fl. Groenl. ed. 2:132. 1890. TYPE: not known.

C. scirpoidea var. *europaea* Kükenthal, in Engler, Pflanzenreich 38 (IV: 20): 81. 1909. TYPE: NORWAY. Solvagtind, *Kneucker 181* (not seen).

C. scirpiformis Mackenzie, Bull. Torrey Bot. Club 35: 270. 1908. *C. scirpoidea* var. *scirpiformis* (Mackenzie) O'Neill & Duman, Rhodora 43: 417. 1941. TYPE: CANADA. Alberta: Banff, damp ground near Middle Spring, 28 Jun 1899, *McCalla 2348* (HOLOTYPE: NY!; ISOTYPE: CU! WTU!).

C. athabascensis Hermann, Leafl. W. Bot. 8: 111. 1957. TYPE: CANADA. Alberta: Jasper National Park, on mossy rocky shelf on marl upper shore of Athabaska River above Athabaska Falls, alt. 3800 ft., 20 miles southeast of Jasper, 28 Aug 1956, *Hermann 13498* (HOLOTYPE: US!; ISOTYPES: ALTA!, CAN!, MICH!, NA).

Rhizomes short and creeping. Culms one to several per node, arising from current year shoots (lacking the withered persistent leaf bases of the previous year), scabrous especially at apex. Pistillate culms 0.3–1 mm wide at top, (0.6) 0.8–1.7 mm at base, (5) 10–35 (40) cm tall. Staminate culms 0.5–1 mm wide at the top, 0.8–1.4 mm at base, (3) 9–14 (26) cm tall. Leaf sheaths of the rhizome and the culm bases red-brown to brown-black, glabrous, shiny, coriaceous. Leaves of the flowering shoots 2–5, not clustered along the stem, adaxial surface glabrous, margins scabrous especially towards apex; in pistillate plants (3.5) 11–20 cm long, 1.5–3 (3.4) mm wide; in staminate plants 8–25 cm long, 0.8–2.6 mm wide. Vegetative leaves 5–8 per shoot; in pistillate plants (5) 13–24 (31) cm long, (1.1) 1.5–2.5 (2.7) mm wide; in staminate plants 8–25 cm long, 0.8–2.6 mm wide; ligules semicircular, (0.5) 1–2

(2.3) mm in height, 0.2–0.4 mm wide. Inflorescences unisexual, unispicate, (very rarely with a short sessile lateral spike of the same sex), erect, linear, densely flowered; pistillate spikes (7.5) 10–30 (37) mm long, 3–5 mm wide; staminate spikes 10–25 mm long, 0.5–0.8 mm wide. Involucral bracts usually present, foliaceous or scale-like, shorter than the inflorescence, 3.5–20 cm long, base inserted 2.5–17.5 mm below spike, auriculate. Pistillate scales ovate, (1.5) 1.8–2.5 (2.9) mm long, 1–1.5 mm wide, shorter than, equal to, or longer than the perigynia, apically acute to obtuse, red-brown to brown-black with narrow to broad hyaline margins; central midrib narrow, green-tawny to dark brown, shorter than or extending to apex; margins entire, often ciliate. Staminate scales similar to pistillate, 3.5–4.3 mm long, 1–1.3 mm wide. Perigynia ovate, (1.8) 2–2.5 (3) mm long, (0.9) 1–1.2 (1.5) mm wide, as wide as the subtending scale, abruptly contracted to a beak, generally lacking a short basal stipe, adaxial surface with few obscure short nerves at base, marginal veins not evident, pale green to tawny, becoming red-brown towards apex, hirsute to villose with white hairs; body tightly enveloping the achene; beak 0.1–2 mm long, red-brown and hyaline at tip, straight at maturity, orifice entire and circular. Achenes dark brown, (1) 1.5–1.8 mm long, (0.6) 0.8–1.2 (1.5) mm wide, lacking a stipe, filling the perigynia or at least $\frac{3}{4}$ the length and width. Rachilla absent. Anthers 1.5–2.5 (3) mm long.

DISTRIBUTION. *Carex scirpoidea* ssp. *scirpoidea* is the most widely ranging taxon in section *Scirpinae* (Figure 1). This subspecies is distributed across northern North America from Greenland, Labrador, and Newfoundland west to the Northwest Territories and Alaska, south to northern New England, northern New York, northern Ontario, northwestern Minnesota, North Dakota, and in the mountains in Colorado, Utah, Nevada, Montana, Idaho, Wyoming, eastern Oregon, and British Columbia. A number of populations occur in Russia on the Kamchatka and Chukotskiy Peninsulas. One disjunct population occurs on Solvagtind Mountain in Norway.

HABITAT. Most often ssp. *scirpoidea* occurs on wet substrates with a high level of calcium (2058 ppm. to 2.52%; Dunlop 1990). In New England, ssp. *scirpoidea* occurs in widely scattered sites where there is some influence from calcareous parent material,

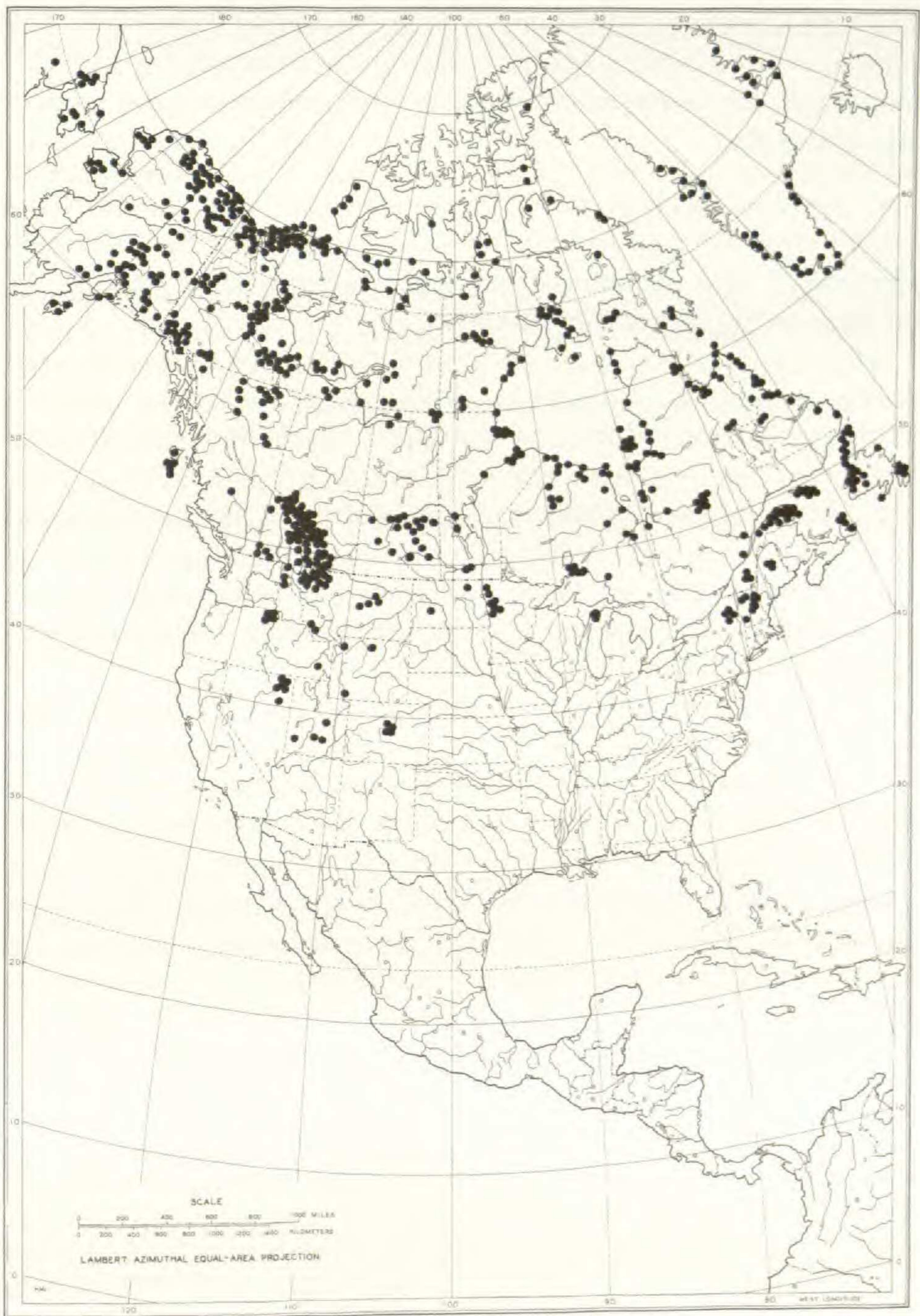


Figure 1. Distribution of *Carex scirpoidea* ssp. *scirpoidea* in North America and Beringia.

and with associated calcicoles such as *Potentilla fruticosa* L. and *Juniperus horizontalis* Moench. Based on observations in Newfoundland, ssp. *scirpoidea* grows on both calcareous and serpentine substrates.

A specific location is not known for the type, as Michaux (1803) cites the type locality for *Carex scirpoidea* as "ad sinum Hudsonis," and a photo of the type shows a label bearing the locality as "in borealibus Canadae."

Carex scirpoidea ssp. *scirpoidea* is the most widespread taxon in this section and includes in synonymy a number of taxa formerly recognized by other caricologists. Kükenthal recognized *C. scirpoidea* var. *europaea* from a single disjunct locality in Norway. Although these plants are short in stature, like typical plants of *C. scirpoidea* ssp. *scirpoidea* from alpine habitats, values for the morphological characters fall within the normal range for ssp. *scirpoidea*. There appears to be no justification for distinct taxonomic recognition for this population.

Another taxon, *Carex scirpiformis*, had been recognized previously by Mackenzie (1908) and treated at the varietal rank by O'Neill and Duman (1941) based on wide, hyaline, pistillate scale margins and light colored pubescence. In addition, Hermann (1957) recognized *C. athabascensis* as a separate species based on the overall robust habit and small, ovoid achenes. These morphological characters of scale margins, pubescence, and size fall into the range of variation for *C. scirpoidea*.

REPRESENTATIVE SPECIMENS: **Canada.** ALBERTA: Brazeau National Forest, Whitehorse Creek, 26–28 Aug 1957, *Porsild* 20824 (CAN); Bow River near Pilot Mt., 19 & 26 Jun 1945, *Porsild & Breitung* 12304 (CAN); Cline River, on David Thompson Hwy., 27 mi. E of Jasper-Banff Park Boundary, 3 Jul 1968, *Dumais & Anderson* 2930 (CAN); Coleman, The Gap, 3 Aug 1957, *Russel* 559367 (USAS); Crystal Lake, 31 Jul 1953, *Breitung* 17007 (NA); Kananaskis Lakes, along Trans-Canada Highway, upper Marmot Creek Basin, 1 Jul 1963, *Mosquin & Benn* 5206 (DAO, SASK); Laggan, 11 Jul 1904, *Macoun* 64054 (CAN); Kananaskis Road, 50°13'N, 114°32'W, 30 Aug 1964, *Calder* 37292 (DAO); Peyto Lake, 66 mi. N of Banff, 12 Jul 1941, *Weber* 2427 (CAN, COLO, GH, WS, UBC); Quartz Ridge, 51°02'42"N, 115°46'10"W, 21 Aug 1972, *Hudson & Scotter* 2789 (SASK); Windy Point, 30 mi. W of Nordberg on the David Thompson Hwy., 52°15'N, 116°23'W, 16 Jun 1974, *Dumais* 6810 (WAT); North Saskatchewan River, between Mt. Athabaska and Saskatchewan Glacier, near mile 114, 22 Aug 1945, *Porsild & Breitung* 14542 (CAN); Sundance pass near Sulfur Mt., 10 Aug 1954, *Ledingham* 1954 (USAS); Jasper National Park, Angel Glacier, Mt. Edith Cavell, 4 Aug 1941, *Scamman* 2428

(GH); Jasper National Park, Athabaska River, Athabaska Falls, 20 mi. SE of Jasper, *Hermann 13498* (CAN, MICH); BRITISH COLUMBIA: Alaska Highway, Summit Pass, foot Mt. St. George, mile 392, 10 Aug 1962, *Eastham 118/62* (UBC); Red Mt., W end Quiniscoe Lake, 49°04'N, 120°13'W, 4 Aug 1956, *Calder, Parmelee & Taylor 19782* (DAO, WTU, MIN); 24 mi. E of Golden, Kicking Horse River, 25 May 1938, *McCabe 6297* (CAS, UC); Banff-Windermere Road, near Vermilion Crossing, 11 Jul 1944, *McCalla 8429* (DAO, UBC), *8430* (UBC); Mt. Assiniboine, 32 mi. Banff, Sunburst Lake Camp, 7–17 Aug 1952, *Scamman 6590, 6591* (CAN); Muncho Lake, 2 Jun 1944, *Porsild 9023* (CAN); Mount Robson Prov. Park, Mt. Ann Alice, above Berg Lake, 53°10'N, 119°11'W, 19 Aug 1956, *Jenkins 7235* (DAO); Queen Charlotte Island, Canoe Pass, 26 Jul 1910, *Spreadborough 83090* (CAN); Spinel Lake, 57°50'N, 126°23'W, 4 Aug 1977, *Gillett & Boudreau 17735* (CAN); Wicked River, 56°3'N, 123°40'W, 16 Jul 1932, *Raup & Abbe 3863* (CAN, F, GH, MIN, MT, NY, US); Windermere, slopes Paradise Mine, 31 Jul 1953, *Calder & Savile 11273* (DAO); Yedhe Creek, near 58°33'N, 125°23'W, 10 Jul 1971, *Annas s.n.* (DAO); Yoho National Park, Emerald Lake, 4 Jun 1947, *McCall 9591* (ALTA, UBC); LABRADOR: Anchorstok Bay, 1934, *Potter & Brierly s.n.* (US); Battle Harbour, Rawson-MacMillan Expedition, 1927, *Sewall 195* (GH, F); Cape Mugford, 57°55'N, 61°55'W, 11 Aug 1939, *Dutilly, O'Neill & Duman s.n.* (DAO); Fraser Canyon, Lake Tasisuak, 100 km from Nain, 10 Aug 1973, *Shepard & Matthews 82* (CAN); Gerin Mt., 55°04'N, 67°14'W, 21 Jul 1955, *Viereck 666* (CAN); Hamilton Inlet, Rodney Mundy Island, Indian Head, 54°27'N, 57°12'W, 8 Jul 1931, *Abbe & Hogg 132* (CAN, GH); Hebron, 58°15'N, 62°40'W, 17 Jul, 1939, *Oldenburg 38a* (MIN); Hopedale, 55°27'N, 60°12'W, 25 Jul 1928, *Bishop 147* (CAN, GH); Knob Lake, Schefferville area, 54°45'N, 66°40'W, 23 Jun 1963, *Hustich & Kalio 213* (CAN); Marble Lake, 54°25'N, 66°26'W, 12 Jul 1967, *Mäkinen 67-503* (CAN); Nain, 12 Jul 1937, *Potter 7421* (WIS), 16 Aug 1937, *7425* (WIS); Torngate Region, Kangalaksiorvik, 59°25'N, 63°40'W, 6 Aug 1931, *Abbe 135* (CAN); Rowsell Harbor, 58°58'N, 63°15'W, 20 Jul 1931, *Abbe & Odell 133* (GH); Windy Tickle, 18 Aug 1937, *Walker 1126* (PH); MANITOBA: Brandon, 15 Jul 1951, *Stevenson 366* (DAO); Cowan, 30 mi. E of Swan Lake, 12 Jul 1950, *Scoggan & Baldwin 7966* (CAN); Hudson Bay, 13 Jun 1950, *Brown 631* (NHA); Fort Churchill, 4 Aug 1948, *Gillett 2392* (MAINE); Gillam, 21 Aug 1950, *Schofield 1523* (CAS, DAO, NY, WS); Ilford, 56°20'N, 95°60'W, Jul 1976, *Sims 1108* (CAN); Lake Winnipegosis, between Cedar Lake and Lake Winnipegosis, 17 Aug 1948, *Scoggan 4651* (CAN); Landing Lake, 23 Jul 1951, *Irvine 761* (DAO); Moosehorn, 110 mi. W of Winnipeg, 9 Jul 1951, *Scoggan 9299* (CAN); Nelson River, Gillam Island, about 15 mi. above Port Nelson, 30 Jul 1949, *Scoggan 6267* (ALTA, CAN, GH, MIN, MT), 4–12 Sep 1946, *Tryon & Dahl 129* (MIN); NEW BRUNSWICK: Aroostook River Basins, Aroostook Falls, ledges, (both sides of river according to label), 15 Jun 1940, *Chamberlain 1579* (MAINE, UC); NEW-FOUNDLAND: Avalon Pen., Conception Bay, Topsail, 12–19 Aug 1901, *Howe & Lang 1207* (GH, NY); Bear Head, 26 Jul 1951, *Rouleau 2072, 2074* (DAO, MT); Bellburn's limestone barrens on W Rt. 430, 19 Aug 1986, *Dunlop & Orlando 2505* (NHA); Blowmidon Mts., roadside, 1.8 mi. W of Rattling Brook on Rt. 460, 19 Aug 1986, *Dunlop & Orlando 2473* (NHA); Bonne Bay, Shag Cliff, 9 Aug 1929, *Fernald, Long & Fogg 1404* (GH, MT, NY); Eagle's Nest

Brook, Mine Brook, York Harbor Mine, 12 Jul 1952, *Rouleau 3064* (MT); Eddie's Cove, 28.4 mi. W of junct. Rt. 345 and new Rt. 430, 23 Aug 1986, *Dunlop & Orlando 2524* (NHA); Frenchman's Cove, 19 Aug 1965, *Rouleau 9946* (MT); 1 mi. W of Steady Brook, 19 Jul 1979, *Hellquist & Crow 13555* (BOSC); Marble Mt., S side facing Humber River on Rt. 1, 19 Aug 1986, *Dunlop & Orlando 2480* (NHA); Point Ritchie, Porte aux Choix, Aug 1986, *Dunlop & Orlando 2510* (NHA); Green Island Cove, 23 Aug 1986, *Dunlop & Orlando 2522* (NHA); Table Mountain radar site, 4 km W, 18 Aug 1986, *Dunlop & Orlando 2440* (NHA); Winterhouse Brook, *Dunlop & Orlando 2481* (NHA); NORTHWEST TERRITORY: Adelaide Peninsula, near E side Sherman Basin, 12 Jul 1957, *MacPherson 66* (CAN); Alexander Falls, Andersen River, reindeer grazing preserve, 69°40'N, 128°57'W, 23 Jul 1965, *Scotter 7070, 7089* (DAO); Burnside Harbour, 12 Aug 1944, *Oldenburg 44-729* (MIN); Baffin Island, Apex Hill, 63°45'N, 67°15'W, 7 Aug 1964, *Swales s.n.* (RM); Arctic Bay, Admiralty Inlet, 12 Aug 1927, *Malte 118543* (CAN); Acadia Cove, Resolution Island, 27 Jul 1937, *Potter s.n.* (WIS); Clyde Inlet, 3 Jul 1950, *Wynne-Edwards 8904* (CAN); Baffin Island, Frobisher Bay, Point Brewster, 3 Aug 1937, *Potter 8294* (CAS); Bathurst Inlet Region, 66°52'N, 108°18'W, 2 Aug 1979, *Scotter & Zoltai 32026* (DAO); Baker Lake, 20 Jul 1963, *Choque s.n.* (MT), 10 Aug 1947, *Freeman s.n.* (DAO); Belcher Island, SW shore Kasegelik Lake, 12 Aug 1959, *Freeman 5062* (TRTE); Point Separation, 68°20'N, 133°30'W, 15 Jun 1927, *Porsild & Porsild 1888* (CAN); Canol Road, mile 111, Bolstead Creek, 25 Jul 1944, *Wynne-Edwards 8252* (CAN); Cape Dalhousie, 70°13'N, 129°40'W, 31 Jul 1963, *Cody 13137* (DAO); Cache Creek, 68°16'N, 136°22'W, 20 Jun 1973, *Welsh & Rigby 12042* (CAN); Cli Lake, 10 Aug 1961, *Cody & Spicer 12204* (DAO, US); Chick Lake, 65°53'N, 128°07'W, 15 Aug 1973, *Gubbe 310(100), 315(99)* (ALTA, SASK); Devon Island, Truelove Inlet, 75°41'N, 84°40'W, 16 Jul 1974, *Mackenzie 18* (CAN); Eskimo Lake, 68°57'N, 132°43'W, 6 Aug 1957, *Cody & Ferguson 10489* (DAO); Ellesmere Island, 78°53'N, 75°50'W, 14 Jul 1979, *Gillett & Schepanek 18105* (COLO); Great Bear Lake, Sawmill Bay, Leith Peninsula, 15-16 Jul 1948, *Shacklette 3032* (MICH, MT, US); Hudson Bay, Kugong Island, 56°11'N, 80°05'W, 29 Jun 1971, *Manning s.n.* (DAO), 5 Jul 1971, *Manning s.n.* (DAO), 7 Sep 1971 (DAO); James Bay, Solomons, Temple Island, 14 Jul 1949, *Baldwin 1657a* (MAINE), *1691* (MAINE, MICH); Jean-Marie River on Mackenzie Highway, 15 Jun 1973, *Skogland 793* (SASK); Coral Harbour, Munn Bay, 9 Aug 1948, *Cody 1959* (MT); Munn Bay, 9 Aug 1948, *Cody 1950* (NA); Murchison River, 67°46'N, 93°52'W, 20 Aug 1975, *Gubbe, Maddison & Burr 862* (SASK); Tehek Lake, 2 Aug 1952, *Oldenburg 52-80* (MIN); Thelon River, 64°45'N, 96°25'W, 27 Aug 1975, *Gubbe, Maddison & Burr 1042* (SASK); Mackenzie River, N peak of Nahanni Mt., 9 Jul 1944, *Wynne-Edwards 8431* (CAN); Lone Mt., 7 Jul 1944, *Wynne-Edwards 8432* (CAN); Carcajou Lake, 64°42'N, 127°55'W, 16 Jul 1965, *Youngman & Tessier 717* (CAN); Coral Peaks, 65°05'W, 129°11'W, 10 Jul 1972, *Cody & Brigham 20715* (DAO); O'Grady Lake, 63°05'N, 128°50'W, 29 Jul 1967, *Cody 16928* (DAO); Redstone River Region, 62°55'N, 126°38'W, 21 Jun 1963, *Kvale & Haggard 43* (DAO); Sekwi Mt., 63°30'N, 128°40'W, 3 Aug 1967, *Cody 17363* (DAO); South Nahanni River, 61°20'N, 124°28'W, 2 Jul 1970, *Scotter 12577* (DAO); Mount Flett, 32 mi. N of Fort Liard, 62°42'N, 123°37'W, 1 Aug 1961, *Cody & Spicer 11884* (DAO); Nahanni

National Park, 61°29'N, 109°28'W, 24 Jul 1976, *Talbot 6110* (CAN); Mistake Bay, 62°05'N, 93°06'W, 20–29 Jul 1930, *Porsild 5638* (CAN); Mt. Sidney, Dobson, 26 Aug 1975, *Scotter & Marsh 5665* (SASK); North Sleeper Island, 59°17'N, 80°40'W, 2 Sep 1939, *Dutilly, O'Neill & Duman 87568* (MO); Norman Wells, Bosworth Creek, 29 Jul 1953, *Cody & Gutteridge 7660* (DAO, F, GH); Rankin Inlet, 62°49'N, 92°05'W, 17 Jul 1973, *Gillett 16067* (CAN); Victoria Island, Cambridge Bay, 12 Aug 1959, *Calder, Savile & Kukkonen 24152* (DAO); NOVA SCOTIA: Inverness Co., Corney Brook, 29 Aug 1956, *Webster 633* (CAN, DAO, MT); LeBlanc Brook, Cheticamp River, 6 Jul 1953, *Smith et al. 7754* (MT), 28 Aug 1956, *Webster 630* (CAN, DAO, MAINE); Victoria Co., Salmon River, Lockhart Brook, 8 Jul 1952, *Smith et al. 6385* (DAO); Cape Breton Co., North Sydney, Cape Breton, 13 Jul 1883, *Macoun 31-835* (CAN); ONTARIO: Cochrane District, Albany River, 51°13'N, 84°22'W, 7 Aug 1960, *Dutilly & Lepage 38558* (DAO); Mammamatawa, 50°16'N, 84°47'W, 2 Aug 1960, *Lepage 38340* (DAO); North French River, 50°26'30"N, 81°03'W, 20 Jul 1979, *Riley 11026* (CAN); Kenora District, Aquatuk Lake, Patricia Portion, 54°21'30"N, 84°36'W, 11 Aug 1980, *Riley 11763* (MICH); Black Duck River, 19 Jul 1953, *Moir 1939* (CAN, MIN); Brant River, 22 May 1973, *Maycock 19226* (TRTE); Goose Creek, Hudson Bay, 18–20 Aug 1952, *Moir 1556* (MIN); James Bay, River Opinaga, 54°12'N, 26 Aug 1953, *Lepage 31622* (DAO); Jigsaw Islands, 13 Jul 1958, *Baldwin 7631* (CAN); Henrietta-Maria, Hudson Bay, 54°48'N, 82°20'W, Jul 1979, *Sims 2649b* (MICH); James Bay, Winisk River, 55°05'N, 85°20'W, 10 Aug 1962, *Dutilly & Fernet 40003* (MT); James Bay, Albany River, 7 Aug 1960, *Duman 38578* (MY); Thunder Bay District, Lake Nipigon, Flat Rock Portage, E side of South Bay, 26 Jul 1960, *Garton 7797* (MSC, MT, NHA); Thunder Cape, 48°20'N, 88°50'W, 31 Jul 1936, *Taylor, Losee & Bannan 1473* (CAN, GH); Terrace Bay, 48°46'N, 87°07'W, 13 Jul 1966, *Parmellee & Savile 3646* (DAO); Mortimer Island, Bernard Point, 48°40'N, 87°04'W, 30 Jun 1973, *Given & Soper 73166* (MICH); QUEBEC: Black Lake, Caribou Hill, 16 Jul 1951, *Raymond et al. 1457, 1626* (DAO, MT); Caribou Lake, 20 May 1965, *Blais et al. s.n.* (CAN, SASK); Coleraine, 3 Aug 1977, *Beach 43* (TRTE); Diana Bay, 10 Aug 1936, *Ney & Courtright 2404* (CAN); Fort Chimo, 22 Jul 1963, *Legault 6770* (DAO, MT, SASK); Great Whale River, 2 mi. N of Hudson Bay Post, 55°17'N, 77°47'W, 1 Aug 1949, *Savile 562* (MT, NA); Marble Mountain, North Canton, 19 May 1970, *Hamel, Forest & Brisson 70048* (DAO); Mont Caribou, 7 Jun 1981, *Blondeau s.n.* (CAN); Mont Logan, 20 Jun 1948, *Levesque 48400* (DAO); Shickshock Mts., 27 Aug 1882, *Macoun 31-836* (CAN); Mistassini Territory, Lake Alanel, Presqu'île Sylvie, 51°5'44"N, 73°43'W, 1–7 Aug 1944, *Rousseau & Rouleau 1227* (MT); Gaspé, Bonaventure Co., Bonaventure River, 2–9 Aug 1904, *Collins, Fernald & Pease 5795, 5934, 5935* (GH); Gaspé-Est Co., Ile Bonaventure, 28 Jul 1950, *Fabius & Allyne 3029* (DAO); 3 mi. W of Cap-des-Rosiers-Est, 18 Aug 1971, *Morisset 71-581* (CAN); Grand River, 21 Jul 1975, *Churchill 722104* (MSC); Mt. Percé, 25 Jul 1905, *Williams, Collins & Fernald* (GH, MIN); Petit Pabos River, 2 Jul 1941, *Scoggan 1802* (CAN); Gaspé-Ouest Co., Mont Albert, 21 Jul 1906, *Fernald & Collins s.n.* (CAN, GH, MSC, MT, VT, US); Saint Ann River, Parc de la Gaspésie, 31 Jul 1956, *Raymond 68192* (MT); L'Île d'Anticosti, Cirque à la Chaloupe, 7 mi. from ocean, 14 Jul 1942, *Rousseau 52282, 52283* (MT); Rivière du Brick, 23 Jul 1927, *Marie-Victorin & Rolland-Germain 27-*

510, 511 (CAN, CAS, F, MO, MT, NY, PH, WS); Rivière Chicotte, 24 Jul 1927, *Marie-Victorin & Rolland-Germain* 27-512 (CAS, MT, MO, NY, UC, WIS); Rivière à la Patate, 25 Jul 1925, *Marie-Victorin et al.* 20100 (MT, NY, WIS, US); Rivière au Saumon, 11 Aug 1927, *Marie-Victorin & Rolland-Germain* 27-509 (MO, MT, US); Rivière Pavillon, 17 Jul 1942, *Rousseau* 52313 (MT); Rivière Vaureal, 27 Jul 1925, *Marie-Victorin & Rolland-Germain* 20495, 20496, 20497 (MT, US, NY); Matane Co., Mt. Collins, Nettle Gully, 9 Jul 1923, *Fernald et al.* 25509 (CAN, CAS, F, GH, MO, MT, NY, UC, US); Mt. Pembroke, Kowal 78 (WIS); Cape Jones, N of portage, 24-25 Jun 1947, *Baldwin, Hustich, Kucyniak & Tuomikosky* 333 (CAN, WS); James Bay, Opinaca River, 54°12'N, 26 Aug 1953, *Dutilly* 31622 (MT); South Twin Island, 53°8'N, 80°00'W, 15 Jul 1929, *Porsild* 4213 (CAN); Solomons Temple Island, 14-17 Jul 1949, *Baldwin* 1657, 1693 (CAN); Bear Island, 17 Aug 1947, *Coates s.n.* (CAN); Pte. au Huard, Pint Hills, 11 Jul 1947, *Baldwin et al.* 334 (CAN); Port Harrison, 58°17'N, 78°10'W, 18-20 Aug 1928, *Malte* 120819 (CAN); Richmond Gulf, 14 Aug 1944, *Lepage & Dutilly* 13103 (GH); Smith Island, east coast of Hudson Bay, 60°47'N, 78°36'W, 24 Aug 1928, *Malte* 120899 (CAN, GH, MT); Ungava District, Knob Lake near Lake Gillard, 16 Aug 1948, *Hustich* 540 (GH, MT); Payne River, near 60°N, 71°25'W, 11 Aug 1948, *Rousseau* 1121, 1143 (MT); Portland Island, 55°20'N, 78°50'W, 13 Sep 1939, *Dutilly, O'Neill & Duman* 87948 (BH, DAO, GH, MIN, MT, PAC); Porpoise Cove, Hopewell Sound, 10 Sep 1939, *Dutilly, O'Neill & Duman* 87799 (USAS, US); Port Manners, 56°58'N, 61°23'W, 9 Aug 1939, *Dutilly, O'Neill & Duman* 7726 (DAO); Mont Reed, 52°1'N, 68°05'W, 20 Jul 1961, *Landry* 762 (MT); Ungava Bay, near Korok Bay, 21 Jul 1951, *Rousseau* 416 (MT); Windy Tickle, 55°46'N, 60°20'W, *Dutilly, O'Neill & Duman* 7459 (US); Walrus Point, 13 Jul 1947, *Baldwin et al.* 336 (CAN); Wakeham Bay, 61°40'N, 72°5'W, 30 Jul 1928, *Malte* 120262 (CAN); SASKATCHEWAN: Churchbridge, E of Yorktown, Grand Trunk Pacific Railway, 4 Jul 1908, *Macoun & Herriot* 72763 (GH, US); Dry Lake, 12 mi. S of Indian Lake, 16 Jun 1964, *Ledingham et al.* 3736 (DAO); Hasbala Lake, 59°55'N, 102°05'W, 13 Jul 1963, *Argus* 173-63 (CAN, DAO, GH, SASK); Insinger, 5 mi. N, 15 Jun 1952, *Boivin & Alex* 9313 (DAO, SASK); Kisbey, 13 Jul 1951, *Boivin & Dore* 7821 (DAO); Lipton, *Clokey* 294 (UC, US); McIntyre Creek, 1 mi. E of Quantock, 7 Aug 1980, *Ledingham* 6840 (USAS); Muenster, 11 Jul 1928, *Ledingham s.n.* (SASK); Mortlach, 12 Jun 1950, *Ledingham* 791 (USAS); Paterson Lake, 59°55'N, 102°20'W, 27 Jul 1963, *Argus* 443-63 (SASK); Patience Lake, 3 Jun 1940, *Ledingham s.n.* (SASK); Prince Albert, 19 Jun 1949, *Ledingham* 49-251 (MT, SASK, USAS); Quillwort Lake, S of Hasbala Lake, 59°54'N, 102°05'W, 28 Jul 1962, *Argus* 843-62 (SASK); Raymore, 12 mi. N of Tower, 4 Jul 1976, *Hudson* 3166 (DAO, SASK, USAS); Watson, 19 Jul 1952, *Russell* 521-87 (DAO); Wiseton, 27 May 1978, *Hudson* 3513 (DAO, SASK, USAS); E of Yorkton on Grand Trunk Pacific Railway, 4 Jul 1906, *Macoun & Herriot* 72763, 72764 (F); YUKON TERRITORY: Atlin Lake, 60°22'N, 133°51'W, 19 Aug 1943, *Raup & Correll* 11438 (MICH); Blackstone Valley, along Dempster Hwy. mile 83, 4 Jul 1968, *Porsild* 1513 (CAN); Boulder Creek, 68°27'N, 138°13'W, 22 Jun 1974, *Nagy & Goski* 74-159 (DAO); Bridge Creek, 61°35'N, 138°50'W, 6 Jul 1948, *Raup, Drury & Raup* 13345 (AA, CAN, GH); British Mountains, 69°13'N, 139°37'W, 21 Jul 1972, *Wein et al.* 264 (DAO); 90 mi. NW of Dawson City, SE of Mt. Klotz, 62°21'N,

140°06'W, 6 Jul 1973, *Greene* 386, 389 (ALTA, DAO); Donjek River, 11 Aug 1927, *Müller s.n.* (NY); Firth River, 69°22'N, 139°25'W, 18 Jul 1972, *Wein et al.* 269c (DAO); Kaskawulsh Nunatak, jct. of N and central arms Kaskawulsh Glacier, W of Kluane Lake, Jul–Aug 1965, *Murray & Murray s.n.* (DAO); Kluane National Park, Bullion Creek–Sheep Creek Plateau, ca. 7 km NW of Slims River, 3 Jul 1975, *Douglas* 8471 (DAO); Lapie Lake, near mile 105, Rose–Lapie R. Pass, 10 Jun 1944, *Porsild & Breitung* 9290 (GH); McQuesten area, 63–64°N and 136–138°W, 12 Aug 1948, *Campbell* 809 (CAN); mile 123 Haines Highway, (ca. 6.5 km W), 11 Jul 1975, *Weaver* 137, 138 (DAO); 24-mile Cabin on 60-mile Road from West Dawson to Alaskan border, 64°13'N, 140°06'W, 15 Aug 1949, *Calder* 4517 (CAS, RM, MT, NA, WS); 60-mile Road, 57 mi. from Dawson to Alaskan border, 64°05'N, 140°53'W, 9–10 Jul 1949, *Calder & Billard* 3590 (DAO); mile 85 Haines Road, 17 Jul 1944, *Clarke* 554 (CAN); Mt. Caribou, N of Carcross, 60°14'N, 134°42'W, *Calder* 4528 (MT); Mt. Sedgwick, British Mts. 68°53'N, 139°06'W, 19 Jul 1962, *Calder* 34460 (DAO); Mt. Schaeffer, 67°43'N, 139°48'W, 10 Aug 1971, *Wein et al.* 142d (DAO); Mt. White 7 mi. E of Little Atlin Lake, 19 Aug 1943, *Raup & Soper* 11438 (SASK); Old Crow Flats, 68°15'N, 138°50'W, 11 Jul 1970, *Welsh & Rigby* (NY); Ogilvie Mts. 65°37'N, 138°56'W, 26 Jul 1960, *Calder & Gillett* 26004 (DAO); 52 mi. NE of Dawson, 15 Jul 1963, *Youngman & Tessier* 342, 343 (CAN); Ptarmigan Heart, 61°49'N, 138°35'W, 16 Jul 1948, *Raup, Drury & Raup* 13701 (AA, CAN, MICH); Red Tail Lake, 61°50'N, 138°52'W, 9 Jul 1948, *Raup, Drury & Raup* 13469 (AA, CAN); Ruby Range, Gladstone Creek, 61°17'N, 138°36'30"W, 12 Jul 1966, *Neilson* 816 (CAN); St. Elias Mts., Dezadeash River Valley, 3 Jun 1967, *Pearson* 67-22 (CAN); Sam Lake, 13 Jul 1974, *Nagy & Pearson* 74-304 (DAO); Spruce Creek, 19 Jul 1974, *Nagy & Pearson* 74-477 (DAO); Yeiken River, Rink Rapids, 9 Jul 1902, *Macoun* 53898 (CAN, NY); White River on Alaska Hwy., 21 Jul 1944, *Anderson* 9308 (CAN, GH).

Miquelon. (French) Cape Miquelon, 27 Jul 1937, *Hors* 50 (MT), 22 Jul 1942, *Le Gallo* 187 (MT); Voiles Blanches, 17 Aug 1939, *Hors* 50-a (MT).

Greenland. Arfersiorfih Fjord, 19 Jul 1924, *Porsild s.n.* (CAN, GH, MO, NY, US); Amitsuarsuk, 60°08'N, 44°45'W, 7 Aug 1967, *Hansen, Kliim-Nielsen & Øllgaard* 67-1920 (DAO); Angmagssalik Dist., Gingertivag, 14 Jul 1969, *Hammann & Kliim-Nielsen* 69-1368 (NY); Battle Harbour, 29 Jun 1883, *Waghorne s.n.* (MO); Cape York, 23 Jul 1894, Peary Auxilliary Expedition, *Wetherill* 51 (GH); Disko, Arktiske Station, ca. Neria, 61°33'N, 4 Aug 1931, *Eugenius s.n.* (MT); Disko Island, Mudderbugtsdalen, 69°40'N, 4–5 Aug 1937, *Porsild* 377 (CAN); Egalugialik, Itivdleg, 64°21'N, 50°27'W, 5 Aug 1973, *Feilberg s.n.* (NY); Ella Island, Cape Oswald, Ulvedalen, 72°52'N, 25°10'W, 24 Jul 1932, *Sørensen* 3120 (CAN); Fiskenaesset, 63°13'N, 50°14'W, 16 Jul 1972, *Andersen & Feilberg* 4301 (MO); Gäoseland, Faxe Sø, 70°15'N, 29°W, 21 Jul 1958, *Holmen & Laegaard s.n.* (DAO); Godhaab Gulf, Jordan Hill, 74°07'N, 27 Jul 1930, *Seidenfaden* 825 (NY); Hurry Fjord, 70°52'N, 22°30'W, Liverpool Land, 14 Jul 1963, *Taggart s.n.* (CAN); Igdlorssuit, 17 Jul 1966, *Gravesen & Hansen* 66-1848 (MO); Ikâsaulaq, 65°59'N, 37°26'W, *Astrup & Kliim-Nielsen* 25 (MO); Ikertog, 66°56'N, 52°20'W, 31 Jul 1978, *Moller s.n.* (COLO); Ikerasak Umanaq Distrikt, 70°29'N, 9 Jul 1929, *Porsild s.n.* (CAN, MT); Itivdlerssuaq, 60°10'N, 44°29'W, 28 Jul 1967, *Hansen, Kliim-Nielsen & Øllgaard* 67-535 (CAN); Ju-

lianehaab, near Søen, 30 Aug 1937, *Grøntved 2114* (DAO); Kangerdlugsuak, Knud Rasmussen Land, Skaergaerd Peninsula, 17 Aug 1936, *Wager & Wager s.n.* (DAO); Kangerssuneq Quigordleq, Anivia, 60°19'N, 44°07'W, 4 Jul 1966, *Hansen 66-1047* (MO); Kjerulf Fjord, 8 Aug 1937, *Oosting 1014* (CAS); Kong Oscars Fjord, 72°14'N, 23°55'W, 1 Jul 1956, *Raup, Raup & Washborn 25* (CAN); Kûngmiut, 60°00'N, 44°28'W, 2 Jul 1967, *Hansen, Kliim-Nielsen & Øllgarrd 67-924, 969* (NY); Praestefjeld, 66°55'N, 53°35'W, 5 Jul 1949, *Gelt-ing s.n.* (COLO); Quinqua, 60°21'N, 23 Jul 1925, *Porsild & Porsild s.n.* (US); Scoresbysund, 71°20'N, 24°40'W, 13 Aug 1937, *Sørensen 259* (MT); Skeldal, 72°15'N, 24°W, 16 Jul 1963, *Spearing et al. 171* (MICH); Söudre Strömfjord, 7 Aug 1927, *Erlanson 2584* (MICH, NY); Tasîssârssik Fjord, 66°05'N, 37°00'W, 14 Jul 1963, *Gribbon 28* (CAN); Tasiusak, 61°45'N, 25 Jul 1889, *Hartz s.n.* (MO); Tasersiaq, Cache Point, 14 Aug 1962, *McCormick 201* (PH); Thafjorden, 11 Aug 1935, *Lagerkranz s.n.* (UC); Tornarssuk, Nûa, 59°54'N, 44°21'W, 1 Aug 1967, *Hansen et al. 67-1794* (PH); Trail Island, Holm's Bay, 11 Aug 1929, *Vaage s.n.* (DAO); Tunugdlaifick, Mâjût, 61°04'N, 45°35'W, 31 Aug 1962, *Hansen, Hansen & Petersen 2235* (DAO); Ymer Island, Botanikerbugten, 73°08'N, 25°10'W, 18 Aug 1932, *Sørensen 3116* (CAN).

Norway. Norland Province, Junkerdalen, Salten, Mt. Solvagtind, 66°48'N, 15°35'E, 9 Aug 1859, *Behm s.n.* (UC), 8 Aug 1859, *Schlyter & Behm s.n.* (F, NY) 18 Aug 1883, *Nessen 805* (F), 9 Jul 1948, *Jordal 1202* (F, MICH).

Russia. Kamchatka Oblast, Koryaksky National District, Olyutorsky region, Verkhoturova Island, 26 Jul 1975, *Kharkevich & Kozhevnikov s.n.* (ALA, DAO, UBC); Madadam Oblast, Chukotskiy Peninsula, (NE coast) near mouth of Chegitem River, 12 Aug 1971, *Sekretareka, Sitin & Yurtsev* (ALA); middle branch of Erguveem River (left bank) near mouth of Vatamkaivan River, Pepenveem River, 1 Aug 1970, *Nechaeva* (ALA); middle branch of Utaveem River, 25 Aug 1970, *Kozhevnikov, Nechaev & Yurtsev* (ALA); Coast of Bering Strait, Puoten Bay, 21 Aug 1972, *Gorbukova, Makarova & Plieva* (ALA); Amguenii River Valley, middle branch, 87 km Evgekinot-Iul'tin Road, 5 Aug 1970, *Kozlova* (ALA); North part of Gulf of Laurentiya, 13 Aug 1969, *Afonina & Korobsov* (ALA); Iul'tinsk Region, near Egvekinot-Iul'tin Road, 16 Jul 1978, *Razhivin* (ALA); Anadirskii Region, southern extremity of Pekul'nay Mountains, middle branch of southern Pekul'nayevem River, 8 Aug 1979, *Korobkov & Sekretareva* (NY); Anyuiskoye Upland, 15 Aug 1973, *Petrovsky* (ALA); southern spur of Teniah Mts., at source of the Loran River, 14 Aug 1972, *Gorbukova, Makarova & Plieva* (ALA); SW coast of Chukotskiy Peninsula, near Nunligran settlement, 28 Aug 1970, *Afonina, Korobkov, Plieva & Khrenov* (ALA); Anyuiskoye Upland, Pogingen River, 8 Aug 1976, *Petrovsky & Korobkov* (ALA).

United States. ALASKA: Alaktak, Half Moon, 70°45'N, 155°00'W, 1 Aug 1949, *Spetzman 2439* (CAN, US); Anaktuvuk Pass, 12-15 Aug 1960, *Hultén s.n.* (GH); Alaska Yukon Boundary, 10 Aug 1961, *Hultén* (NY); Alaktak, 155°N, 70°45'W, *Scholander s.n.* (DAO); Atkasuk, Meade River, ca. 100 km SSW of Barrow, 70°28'N, 157°25'W, 7 Aug 1966, *DeBenedictis 534* (CAN, DAO); Bonanza Creek, Eagle Summit, 16 Jul 1949, *Scamman 5270* (GH); Brooks Range, airstrip at 'Nolan', 19 Jun 1949, *Jordal 1839* (BH, MICH); 46 mi. NNW of Arctic Village, 68°40'N, 146°30'W, 18 Aug 1973, *Hettinger 814* (CAN); Cane Creek, 68°35'N, 144°50'W, 8 Aug 1972, *Hettinger 159*

(ALTA); Cape Beaufort, 3–7 Aug 1961, *Hultén s.n.* (DAO, GH); Chip River, 70°26'N, 154°50'W, 17 Jul 1956, *Wiggins 13674* (DS, US); Chitina River head, 16 Jun 1925, *Laing 20* (CAN); Chugach Mts., Anchorage, 29 Jun 1948, *LePage 23355* (US); Circle Hot Springs, 138 mi. N of Fairbanks, 17–22 Jul 1936, *Scamman 69* (GH); Colville River, 150°45'W, 69°45'N, 10 Aug 1953, *Cantlon et al. 649* (MSC); Delta River, S of Donnely Inn, 10 Aug 1966, *Foote 8075* (RM); Daipaious Creek, 21 Jul 1958, *Packer s.n.* (ALTA); Donnely Dome, mile 250 Richardson Hwy., 63°47'N, 145°45'W, 2 Aug 1951, *Cody 6284, 6286* (DAO); Farwell Lake, 62°33'N, 153°36'W, 3–4 Aug 1949, *Drury 2463* (GH); Fairbanks, Miller House on Steese Hwy., 12–28 Jul 1940, *Scamman 2009* (GH); Firth River, 2 mi. S of junction Firth & Mancha Creek, 11 Aug 1961, *Stone* (RM); Fish Creek, 70°19'N, 151°58'W, 26 Jul 1977, *Murray & Johnson 6532* (CAN); Index Mountain 40 mi. ENE of Arctic Village, 68°15'N, 144°10'W, 11 Jul 1973, *Hettinger 235, 246* (CAN, ALTA); Jago Lake, 69°26'N, 143°47'W, 23 Jul 1957, *Cantlon & Gillis 57-1295* (MSC); King Lodge, Border, Dawson Road, (E of Chicken), 12 Jul 1963, *Spetzman 4883* (CAN); Kodiak, 28 Jul 1904, *Piper 4776* (US); Kogosuknuk River, 69°45'N, 151°45'W, 16 Jul 1953, *Borman, Rebuck & Cantlon 351* (MSC); 69°46'N, 151°40'W, 16 Jul 1953, *Borman, Rebuck & Cantlon 398, 403* (MSC); Kongakut River Hill, 138 mi. NNE of Arctic Village, 69°34'N, 141°50'W, 19 Jul 1973, *Hettinger 347* (CAN, ALTA); Kaness River, 15 mi. SSE of Arctic Village, 67°46'N, 143°45'W, 3 Jul 1973, *Hettinger & Boyce 175 & 176* (ALTA); Kotzebue Sound, 9–16 Aug 1945, *Scamman 3967* (GH); Kotzebue, 12 Aug 1938, *Anderson 4679* (CAS); Big River, 61°55'N, 154°25'W, 10 Jul 1950, *Drury 4211* (GH); Kuskokwim River, Swift River, 62°40'N, 152°30'W, 19 Jul 1961, *Viereck 5067* (CAN); Kenai Peninsula, Steton Creek Valley, 3 Aug 1951, *Calder 6444* (CAS, DAO); Moose Pass, 60°32'N, 149°32'W, 31 Jul 1951, *Calder 6388* (DAO); Knife Ridge, 2 mi. N of Knifeblade, 2 Aug 1951, *Jones 717* (WS); Kokrines Mts., 65°17'N, 154°30'W, 6 Jul 1926, *Porsild 659-60* (CAN, MT, US); Lake Noluk, 2 Aug 1950, *Thompson 1337* (DS, US); Lake Schrader, 69°25'N, 145°00'W, 8 Jul 1948, *Spetzman 529* (DS, US); Lazy Mt., E of Palmer, 29 Jul 1965, *Mitchell 729b6* (DAO); Livengood, 9 Jul 1944, *Anderson 9019* (CAN, MSC); Lodiack, 21 Jul 1904, *Piper 4776* (POM); Mt. McKinley National Park, 2 mi. N of N entrance, 29 Jul 1967, *Hermann 21517* (MICH, NY); Mt. Eielson, Coppers Mt., 11 Jul 1956, *Viereck 1250A* (MIN, RSA); Hines Creek, 6 Aug 1950, *Bailey 5017* (UC); Savage River, 31 Jul 1932, *Henderson 14790* (ORE); Toklat Cabin, 11 Jul 1939, *Murie 35* (RM); Polychrome Pass, mile 43, 1–10 Jul 1964, *Hultén s.n.* (AA); 63°43'N, 149°15'W, 13–22 Jun 1937, *Scamman 585* (GH); Meade River, ca. 15 km from Atkasuk, 70°28'N, 157°25'W, 30 Jun 1966, *DeBenedictis 92, 534* (MICH); milepost 50, along Pipeline Haul Road, 6 Aug 1981, *Allred, Welsh & White 1214* (RSA); Mt. Dustin, 21 mi. from Nome, 4 Jul 1938, *Anderson 3768* (CAS); Nabesna River, 7 Aug 1902, *Schrader & Hartman 67* (US); Nelchina Caribou Range, Tyrone Creek, (100–200 mi. NE of Anchorage), 28 Jun 1957, *Hanson 57-60, 62A, 119* (US); Nome Quad, meadow below radio tower, Anvil Mt., 64°31'N, 165°30'W, 11 Jul 1982, *Kelso 82-39* (COLO); Nome, 1900, *Blaisdell 139* (UC); Ogotoruk Creek, Cape Thompson, 27 Jul 1966, *DeBenedictis 421* (MICH); Okpilak Valley, 69°25'N, 144°02'W, 30 Jun 1958, *Cantlon & Mal-*

com 58-0117 (MSC); Old John Lake, 27 Jul 1950, *Jordal 3751* (BH, MICH, MT); Pastolik, 5 Jul 1928, *Miller 88c* (US); Port San Juan, Evans Island, 10 Aug 1948, *Eyerdam 7031* (MIN, OSC, RM, WS); Prince of Wales Island, Virginia Mt., 7 mi. S of Pt. Baker, 19 Jul 1972, *Jaques 1476* (OSU); Rapids Lodge, 138 mi. S of Fairbanks on Richardson Hwy., 25–28 Aug 1937, *Scamman 1046* (GH); Seward Peninsula, 64°33'N, 163°45'W, 5–6 Aug 1926, *Porsild & Porsild 1193-94* (CAN, GH); Sheenjek River, 68°22'N, 143°55'W, 19 Jun 1956, *Schaller 54* (MT); Sheenjek River, 68°36'N, 143°45'W, 11 Jun 1956, *Schaller 163* (MT); Snow Camp, Sagavanirkton River, 1958, *Korando & Shanks s.n.* (NY); Sunset Pass, 69°40'N, 144°45'W, 13 Aug 1948, *Spetzman 1154* (CAN, MIN); Tanacross Quad., Sheep Creek, 63°23'N, 143°53'W, 24 May 1977, *Winters 121* (DAO); Taylor Hwy., 64°50'N, 141°15'W, 9 Aug 1965, *Harms 4062* (SASK); Teller, Port Clarence, 6–20 Aug 1949, *Scamman 5433* (GH); Umiat Mt., 2 Jul 1953, *Borman 3394* (MT); 40 mi. NW of Umiat, 29 Jul 1951, *Jones 723* (WS); Umiat, 69°25'N, 152°10'W, 25 Jun 1953, *Bormann, Rebuck & Cantlon 118* (MSC); Upper Marshfork River, 46 mi. NNW of Arctic Village, 68°40'N, 146°30'W, 18 Aug 1973, *Hettinger 814* (ALTA); White River Valley, 61°42'N, 141°39'W, 17 Aug 1968, *Murray 2279* (CAN); Alaska-Yukon Boundary, Firth River and Mancha Creek, 11 Aug 1961, *Stone 1176, 1217* (DS); COLORADO: Park Co., Sheridan Mt., above Hilltop Mine, 12 Jul 1967, *Weber 13299* (COLO); Fairplay, Horseshoe Cirque, T10 R79W S12, 21 Jul 1985, *Dunlop & Orlando 2025* (NHA); South Park, 1873, *Wolfe 1002* (COLO, F, MICH, NY, US); IDAHO: County unknown, Soda Springs, 25 May 1934, *Davis 83-34* (NY); Upper Priest River, 20 Jul 1925, *Epling 7513* (UC); MAINE: Aroostook Co., Aroostook River Basin, 15 Jun 1940, *Chamberlain 1579* (MAINE, UC); Aroostook River, Fort Fairfield, 5 Jun 1901, *Fernald s.n.* (GH, MAINE); Piscataquis Co., Mt. Katahdin, 4 Jul 1856, *Blake s.n.* (MAINE, NHA); North Basin headwall below Hamlin Peak, 1 Aug 1929, *Ewer 226* (MASS); W end of North Basin, 26 Jul 1929, *Ewer 152* (MASS); Chimney Brook, 9 Aug 1926 *Norton, Farring & Rich 17169* (NHA); Chimney Pond, 8 Jul 1900, *Fernald s.n.* (GH, PH); Hawlin Ridge and North Basin, 31 Jul 1923, *Norton, Farring & Rich s.n.* (NHA, USAS, WIS); Trout Brook Mt., T6N R9W, 29 Jul 1946, *Odgen, Chamberlain & Norton 2749* (US); MICHIGAN: Delta Co., Escanaba River, ca. 1 mi. NE of Cornell, ca. 10 mi. NW of Gladstone, 23 Aug 1982, *Voss 15553* (MICH); MINNESOTA: Clay Co., 3 mi. N Downer, 2 Jun 1964, *Stevens 2697* (MIN, UC, US); Audubon Prairie near Moorhead, 23 Jun 1980, *Cross-Leila 167* (MIN); Bluestem prairie near Moorhead, 23 Jun 1980, *Petron 116* (MIN); Polk Co., Pankratz Prairie near Crookston, 18 Jul 1979, *Farrell 117* (MIN); Pembina Trail, 17 Jun 1979, *Sperling 4797* (MIN); Wilkin Co., Barnesville, 17 Jul 1962, *Stevens 2596* (MIN, UC, US); Zimmerman Prairie near Ogema, 26 Jun 1980, *Severson 401* (MIN); MONTANA: Beaverhead Co., Red Rock Pass, 23 Aug 1952, *Booth s.n.* (DAO); Wisdom, 10 Aug 1946, *Booth 1490* (WTU, US); Glacier Co., Cut Bank Pass, 3 Aug 1931, *Cox 643* (US); Hidden Lake Trail, 26 Aug 1962, *Hermann 18300* (MICH, MONTU, US); Logan Pass, 27 Jul 1936, *Pierson s.n.* (CAS); Siyeh Creek, 20 Aug 1985, *Dunlop & Orlando 2256, 2259* (NHA); Lunch Creek, 20 Aug 1985, *Dunlop & Orlando 2264* (NHA); Gunsight Pass, 25 Aug 1919, *Standley 18139* (NY, US); Pigeon Pass, 22 Jul 1958, *Bamberg 92* (COLO); Reynolds Mt., 2 Aug 1960, *Schofield s.n.* (MON-

TU); St. Mary Lake, 6 Aug 1919, *Standley 17150* (US); MacDonald Lake, 3 Aug 1895, *Williams s.n.* (NY, US); Altyn Peak, 13 Jul 1919, *Standley 15596* (NY, US); Divide Mountain, 9 Aug 1964, *Harvey & Pemble 7175* (MONTU, WTU); Teton Co., Pine Butte Preserve, 23 Jun 1982, *Lesica 2055* (MONTU); Antelope Butte, 22 Jul 1982, *Lackschewitz & Ramsden 10049* (COLO, MONTU); Duhr Fen, 16 Aug 1982, *Lesica 2408* (MONTU, WTU); Mt. Patrick Pass, 30 Jul 1983, *Lackschewitz 10609* (MONTU, NY); NEVADA: Elko Co., Ruby Valley, Point Hot Springs, T27N R58E S15, 20 Jun 1984, *Tiehm, Atwood & Williams 8748* (NY, ORE); Ruby Mts., Seitz Lake, T32N R58E S20, 16 Sep 1983, *Goodrich, Smith & Tuhy 20183* (BRY); Ruby Mts., T29N R57E, NW of Harrison Pass, 15 Aug 1980, *Atwood 7713* (BRY); Lamoille Canyon, Thomas Canyon Camp, 15 Jun 1941, *Holmgren 1130* (NY, UC); W of Ruby Mts., along Rt. 229, T32N R60E S19, 4 Aug 1985, *Dunlop & Orlando 2140* (NHA); White Pine Co., Monte Neva Hot Spring, 17 mi. N of McGill, 4 Aug 1985, *Dunlop & Orlando 2130* (NHA); NEW HAMPSHIRE: Carroll Co., Albany, Mt. Chocorua, 4 Jul 1978, *Storks 385* (NHA); Hart's Location, Mt. Willard, Butterwort Flume, 23 Sep 1984, *Dunlop & Orlando 1965-1968* (NHA); Coos Co., Mt. Washington, alpine garden, 31 Jul 1977, *Storks 147* (NHA); Grafton Co., Franconia, Cannon Mt., 4 Aug 1960, *Hodgdon 11670* (NHA); alpine areas of Franconia Mt., *Oakes 3045* (MASS); Mt. Lincoln, summit, 18 Jul 1915, *Fernald & Smiley 11607* (CU, GH, NY, US); Mt. Lafayette, 23 Aug 1865, *Blake* (GH, NHA); Grafton Co., Lyme, on Winslow Ledge, 25 Jun 1984, *Dunlop, Korpi & Hency 2394* (NHA); NEW YORK: Essex Co., N end Indian Pass, 5 Aug 1948, *Smith 4602* (NA); Wilmington, Whiteface Mt., 7 Jul 1986, *Dunlop & Orlando 2414* (NHA); Avalanche Pass, Mt. Marcy, 20 Aug 1924, *Killip 12713* (US); NORTH DAKOTA: Dunn Co., Killdeer Mts., east slope, 11 Aug 1951, *Stevens 1293* (CAN, UC, US); Rolette Co., between Rolette & Thorne, 3 Jun 1913, *Lunell 767236* (MIN, US); OREGON: Wallowa Co., E side Lostine Canyon, 18 mi. above Lostine, 22 Jul 1933, *Peck 17861* (DS, NY, WILLU); Hurricane Creek, 23 Jul 1944, *Peck 22549* (UC, WILLU); Ice Lake meadows, T4S R44E S12, 11 Aug 1961, *Mason 1902* (OSC); UTAH: Duchesne Co., Ashley National Forest, Four Lakes Basin, 22 Aug 1974, *Goodrich 3736* (BRY); Emery Co., Scad Valley, T15S R6E S27, 5 Aug 1984, *Lewis & Lewis 7758* (BRY, UT); Garfield Co., Dixie National Forest, Pine Lake Campground, 31 Jul 1985, *Dunlop & Orlando 2100* (NHA); Upper Henderson Canyon, T35S R1W S32, ca. 11 NE of Tropic, 4 Jul 1983, *Tuhy 863* (RSA); Iron Co., Cedar Breaks, T36S R9W S24, ca. 13 mi. S of Parowan, near Brian Head, 20 Jul 1977, *Welsh & Clark 15512* (BRY, NY); VERMONT: Bennington Co., Mt. Equinox, Deer Knoll, 5 May 1985, *Dunlop, Brackley & Thompson 2003* (NHA); Lamoille Co., Smugglers Notch, Mt. Mansfield, *Pringle s.n.* (CAS, F, GH, MICH, MO, MSC, NHA, NY, PH, POM, UC, VT); Cambridge, in Pringle's Ravine in Smugglers Notch, 4 Aug 1956, *Charette 2288* (VT); Orleans Co., Willoughby Cliffs, 19 Jul 1885, *Deane s.n.* (BH, GH, NY), 25 Jun 1949, *Hodgdon 6046* (NHA); Mt. Pisgah, Lake Willoughby, along Rt. 5A, 16 Aug 1979, *Ahles 78931* (MASS); WYOMING: Johnson Co., Big Horn Mts., 33 mi. NW of Buffalo, T53N R87W S27, 7 Aug 1979, *Nelson 4705* (RM); Park Co., Clay Butte, 15 Aug 1979, *Dorn 3377* (RM); Sheridan Co., Big Horn Mt., T57N R90W S19, 5 Aug 1979,

Nelson 4681 (RM); Tongue River, Aug 1953, *Beetle 6297* (RM); Uinta Co., 5 mi. SW of Hilliard, 25 Jun 1950, *Beetle 11062* (RM).

- 1b. ***Carex scirpoidea*** Michx. ssp. ***pseudoscirpoidea*** (Rydberg) Dunlop, *Novon* 7: 355. 1997. *Carex pseudoscirpoidea* Rydberg, *Mem. N.Y. Bot. Gard.* 1: 78. 1900. *Carex scirpoidea* var. *pseudoscirpoidea* (Rydberg) Cronquist, *Univ. Wash. Publ. Biol.* 17(1): 325. 1969. TYPE: U.S.A. Montana: Spanish Basin, Jul 1896, *Rydberg 3064* (LECTOTYPE: NY! designated by Mackenzie).

Rhizomes elongate, with regularly spaced shoots, internodes 1–2 cm long. Culms usually 1–few per node, arising from shoots of the previous year and retaining the withered, persistent leaf bases of the previous year, scabrous towards apex. Pistillate culms 0.5–1.5 mm wide at top, 0.8–2 mm wide at the base, 5–31 cm tall. Staminate culms 0.9–1.3 mm wide at top, 1.2–2 mm wide at the base, 9–27 cm tall. Leaf sheaths of the rhizome and culm base red-brown to brown-black, glabrous, shiny, becoming fibrous with age. Leaves of the flowering shoots 3–5, clustered, blades diverging from one region up to 20 mm above the culm base, adaxial surface glabrous, scabrous along the margins; in pistillate plants 7–19 cm long, 1.2–3.5 mm wide; in staminate plants 9–12 cm long, 1.5–2.8 mm wide. Vegetative leaves 5–8 per shoot; in pistillate plants 7–21 cm long, 1.6–3 mm wide; in staminate plants 9–13 cm long, 1.5–2.5 mm wide; ligules semi-circular, 1–1.4 mm in height, 1.7–3 mm wide. Inflorescences unisexual, unispicate (very rarely with a short sessile lateral spike), erect, linear to oblong, densely flowered; pistillate spikes 10–34 mm long, 3.5–5 mm wide; staminate spikes 10–20 mm long, 3.5–4 mm wide. Involucral bracts often absent, when present foliaceous, shorter than the inflorescence, 6–40 mm long, occasionally scale-like (less than 1 mm and similar to inflorescence scales), inserted on culms 10–47 mm below spike, base occasionally auriculate. Pistillate scales ovate, 2–2.6 (3) mm long, 1.1–1.5 mm wide, longer and wider than the perigynia, apically obtuse, red-brown to brown-black with narrow to wide hyaline margins, central midrib narrow, dark brown not extending to the scale apex; margins ciliate. Staminate scales similar to pistillate, 2.8–4.5 mm long, 0.8–1 mm wide. Perigynia ovate, (1.5) 2–2.8 (3) mm long, 1–1.6 mm wide, abruptly contracted to a beak, lacking a stipe, nerveless, white to light green, becoming red-brown to dark

brown towards the apex, hirsute with white to tan hairs; body tightly enveloping the achene; beak 0.1–0.3 mm long, red-brown, straight at maturity, orifice entire and oval. Achenes light brown, 1.5–1.8 mm long, 0.9–1.2 mm wide, lacking a stipe, filling the perigynia or at least $\frac{3}{4}$ the length and width. Rachilla absent. Anthers 3 mm long.

DISTRIBUTION. *Carex scirpoidea* ssp. *pseudoscirpoidea* is widely distributed in the higher elevations of the western mountains (Figure 2). It is found chiefly in the San Juan Mountains in Colorado; Uinta and La Salle Mountains in Utah; the Sierra Nevada Range in California; Steen Mountains in Oregon; the Sawtooth Range in Idaho; the Little Belts Range, Anaconda-Pintlar Range and Beartooth Plateau in Montana; and the Okanagan Range in eastern Washington and southern British Columbia.

HABITAT. Subspecies *pseudoscirpoidea* occurs at elevations from 3300 to 3900 m, on dry ridge sites and alpine fellfields with gravelly and non-calcareous soils.

Subspecies *pseudoscirpoidea* is distinct ecologically, occurring chiefly in high elevation sites in mountain ranges in the West. This taxon is distinguished by culms that arise from second year shoots, clothed at the base by the withered and persistent leaf bases of the previous year. Generally, a single culm arises from a node and internodes of the rhizome are elongated, typically 1–2 cm. The leaves are clustered, diverging from the shoot axis at one point approximately 10–20 mm above the rhizome, in contrast to other taxa in which the leaves diverge from the stem at scattered intervals along the shoot axis. The plants generally have shorter and wider leaves than those of ssp. *scirpoidea*.

In lectotypifying *Carex pseudoscirpoidea*, Mackenzie (1935) chose *Rydberg 3064* (NY) as the lectotype. Unfortunately, this is a staminate plant and does not possess some of the diagnostic features of the taxon.

REPRESENTATIVE SPECIMENS: **Canada.** BRITISH COLUMBIA: Cathedral Ridge, ca. 4½ mi. N of Monument 95, 28 Aug 1972, *Douglas & Douglas 4629* (ALA); Cathedral Park, Lake Lady Slipper, 12 Jul 1975, *Hainault 7728* (DAO), 14 Jul 1975, *Hainault 7526* (DAO); Lakeview ridge, 28 Jul 1976, *Hainault 7962* (DAO); Mt. Apex, 11 Aug 1964, *McLean & Haupt 65-64* (DAO), *McLean & Marchand 65-63* (DAO); Mt. Bomford, Cathedral Lakes, Ashnolda District, 49°N, 120°15'W, 11 Jul 1951, *Taylor 1359* (UBC).



Figure 2. Distribution of *Carex scirpoidea* ssp. *pseudoscirpoidea*.

United States. CALIFORNIA: Alpine Co., Carson Pass, Round Top Lake to Fourth of July Lake, 29 Aug 1974, *Taylor 4910* (DAV); Mono Co., Minarets Wilderness Area, Inyo National Forest, Dana Plateau, N of Mt. Dana, T1N R25E S28, 7 Aug 1985, *Dunlop & Orlando 2158* (NHA); COLORADO: Chaffee Co., Monarch Pass, 20 mi. W of Salida, 22 Jun 1926, *Erlanson 2020* (MICH); Manassas Creek, 24 Jul 1919, *Clokey 3337* (BH, MO, NY, RM, UC, US); Gun-

nison Co., North Pole Basin, 14 Jul 1955, *Weber & Barclay 9193* (COLO, CS, DS, MT, NY, RM, RSA, UC); La Plata Co., San Juan National Forest, Chicago Basin, Eoleus, 29 Jul 1962, *Michener 724* (COLO); San Juan Co., San Juan National Forest, Eldorado Lake, T40N R6W, 19 Jul 1971, *Instarr s.n.* (COLO); San Juan National Forest, NoName Basin on Middle Ridge, 6 Aug 1962, *Michener 750a* (COLO); IDAHO: Blaine Co., Sawtooth Range, Devil's Bedstead, 28 Jul 1936, *Thompson 13562* (CAS, CU, PH, MO, NY, WS, WTU); Sawtooth National Forest, head Boulder Creek, 4 Aug 1937, *Thompson 14114 1/2* (CAS, WTU); MONTANA: Beaverhead Co., Oreamnos Lake, 25 Jul 1945, *Hitchcock & Muhlick 12793* (BH, CAS, PH, NY, WS, WTU); Pioneer Range, Black Lion Mountain, 30 Jul 1945, *Hitchcock & Muhlick 12977* (BH, CAS, NY, WS, WTU); Torrey Lake, 27 Jul 1946, *Hitchcock & Muhlick 15050* (CAS); Carbon Co., Moon Lake, 15 Aug 1979, *Lackschewitz 9154* (MONTU); Beartooth Mountains near Wyoming state line, 25 mi. SW of Red Lodge, T9S R19E S32, 22 Jul 1955, *Cronquist 7998* (CAN, CAS, CU, DAO, DS, GH, MICH, MONTU, MT, NY, OSC, RM, RSA, UC, WTU); Hell Roaring Plateau, 25 Jul 1921, *Simms & Zeh 640* (RM); Deerlodge Co., Mt. Tiny above Goat Flats, 10 Sep 1972, *Lackschewitz 4123* (MONTU); Deerlodge National Forest, meadow below Storm Lake Pass, T4N R13W S30 & 31, 24 Aug 1985, *Dunlop & Orlando 2280* (NHA); Anaconda Pintlar Wilderness, T3N R14W S36, SW of Mt. Tiny on Storm Lake trail to Goat Flats, 24 Aug 1985, *Dunlop & Orlando 2285* (NHA); Madison Co., Gravelly Range, Black Butte, 26 Jul 1947, *Hitchcock 16869* (CAS, NY, RSA, WS); Tobacco Root Mts., Mt. Bradley, 26 Aug 1959, *Bamberg 431* (COLO); Taylor Mts., Koch Peak, 2 Aug 1946, *Hitchcock & Muhlick 15194* (CAS, MO, NY, WS, WTU); Missoula Co., Bitterroot Mts., Lolo Peak, 8 Sep 1968, *Lackschewitz & Fageraas 1081 a&b* (MONTU); OREGON: Harney Co., Steen Mts., above Alberson, 5 Jul 1925, *Peck 14272* (CAS, F, PH, WILLU); Big Indian Gorge, T33S R33E S35, 28 Aug 1980, *Wright 1468* (OSC); UTAH: Daggett Co., Leidy Peak, 31 Jul 1929, *Dremolski D-7* (RM); Duchesne Co., Atwood Lake, 28 Jul 1945, *Hayward 39, 40* (BRY); Mt. Emmons, Chain Lakes, Kregs Basin, 18 Jul 1933, *Hermann 4935* (CAS, DS, MICH, MO, NY); Garfield Basin, Bluebell Lake, T4N R5W S31 & 32, 30 Jul 1980, *Neese & Welsh 214016* (NY); Uinta Mts. N slope 1 mi. SE of Island Lake, 25 Sep 1983, *Neely & Carpenter 1892* (COLO); West Granddaddy Mtn., T2N R8W S7, 5 Sep 1984, *Tuhy 2226* (BRY); Yellowstone Canyon, Milk Lake, T4N R5W S25, 2 Aug 1980, *Welsh & Neese 213930* (NY); San Juan Co., La Sal Mountains, W end Dark Canyon, Mt. Peale, T27S R24E S13, 26 Jul 1985, *Dunlop, Orlando & Franklin 2075* (NHA); Mt. Mellenthin, T27S R24E S12, 26 Jul 1984, *Tuhy 1746* (BRY); Summit Co., Bald Mt. summit, 3 Sep 1953, *Lewis 267* (BRY, CAS); near divide W of Fish Lake on N slopes of Uinta Mts., T2N R11E S2, 3 Sep 1945, *Harrison & Harrison 10971* (BRY, US); rocky washes above Dollar Lake, Henry's Forks Basin, 12 Aug 1936, *Maguire, Hobson & Maguire 14580* (CAS, DAO, RM, US, WS, WTU); Lamotte Peak, streamlet below lake, 15 Aug 1933, *Hermann 5971* (RM, MICH, MO); Uinta Co., Uinta Mts., Ashley National Forest, 22 mi. NW of Vernal, T15 R19E S27, 2 mi. E of Marsh Peak, 19 Aug 1982, *Goodrich 17689* (BRY, UT); 2 mi. NW of Paradise Park Res., T3N R1W S2, 5 Jul 1980, *Goodrich 14253* (BRY); E side Leidy Peak, T1N R19E S31, 24 Jul 1986, *Goodrich 22074* (BRY); East Fox Lake, Uinta River, 14 Aug 1953, *Lewis 230* (BRY); WASHINGTON: Okanogan Co.,

Chopaka Mt. ca. 11.5 mi. NW of Loomis, 16 Jul 1972, *Douglas & Douglas* 3858 (DAO); Tiffany Lake Pass, 24 Jul 1931, *Fiker* 406 (WILLU, WS); Windy Peak, ca. 17 mi. NW of Loomis, 17 Aug 1971, *Douglas* 3120 (RM); WYOMING: Fremont Co., Shoshone National Forest, East Fork Wind River, 8 Aug 1962, *Johnson* 249, 250 (CS, RM); Wind River Range, Roaring Fork Mt., 2 mi. NW of Silas Lake, 20–26 Jul 1965, *Scott* 535 (CAN, GH, UC); Johnson Co., Big Horn Forest, Grasshopper Ridge, Elk Lake, 28 Aug 1961, *Johnson* 144 (RM); Park Co., Island Lake, 19 Jul 1948, *Daubenmire* 48330 (WS); Little Bear Creek, cross Hwy. 212, 17 Jul 1973, *Taylor* 1606 (RM); Sublette Co., Bridger National Forest, Bridger Wilderness Area, near Lake Timeco, 5 Aug 1976, *Beetle* 16673 (RM); White Rock Mt., near Green River Lakes, 8 Aug 1925, *Payson & Payson* 4605 (MO, MSC, NY, PH, RM, WS).

1c. ***Carex scirpoidea* ssp. *convoluta*** (Kükenthal) Dunlop, *Novon* 7: 355. 1997. *C. scirpoidea* var. *convoluta* Kükenthal, in Engler, *Das Pflanzenreich* 38 (IV:20): 81. 1909. TYPE: U.S.A. Michigan: Thunder Bay Island, 18 Aug 1895, *Wheeler* s.n. (HOLOTYPE: B destroyed; ISOTYPES: BH! CAN! GH! MICH! MIN! MSC! NY! POM! VT!).

Rhizomes short. Culms one to several per node, arising from current year shoots (lacking any withered persistent leaf bases of the previous year), scabrous especially at the apex. Pistillate culms 0.4–0.7 mm wide at the top, 0.8–2.2 mm wide at the base, (9.2) 19.5–35 (38) cm tall. Staminate culms 0.5–0.9 mm at the top, 0.9–1 mm wide at the base, 9–31 cm tall. Leaf sheaths of the rhizome and the culm base red-brown to brown-black, glabrous, shiny, coriaceous with acute hard tips. Leaves of the flowering shoots 2–4, not clustered, adaxial surface glabrous, margins scabrous; in pistillate plants 7–18 cm long, (0.8) 1.1–1.5 (2) mm wide; in staminate plants 6–15 cm long, 1–1.5 wide. Vegetative leaves 4–9 per shoot; in pistillate plants 10.5–23.4 cm long, (0.7) 1–2 mm wide; in staminate plants 11–16 cm long, 1–1.7 mm wide; ligules semicircular, 0.2–2 (3) mm in height, 1–2 mm wide. Inflorescences unisexual, unispicate (very rarely with a short lateral, sessile or subsessile spike), erect, linear, densely flowered; pistillate spikes slender, (10.6) 15–21 (30) mm long, 2.5–3.5 (4) mm wide; staminate spikes 13–30 mm long, 2–3.5 mm wide. Involucral bract usually absent, when present foliaceous, shorter than the inflorescence, 5–21 mm long, base inserted on culm 5–12 mm below spike, auriculate. Pistillate scales ovate to obovate, (1.5) 2–2.4 mm long, (0.9) 1–1.2 mm wide, equal to or shorter than perigynia, apex obtuse to acute, red-brown to dark brown with narrow to broad hyaline margins, central midrib narrow

green-tawny to dark brown, extending to scale apex; margins entire. Staminate scales similar to pistillate, 2.5–3.2 mm long, 0.7–0.9 mm wide. Perigynia ovate to obovate, 1.5–2.6 mm long, (0.7) 1–1.2 mm wide, as wide as the subtending scale, abruptly contracted to a beak, lacking a stipe, nerves absent, basally light green, becoming tawny to red-brown towards apex, hirsute with white to tan hairs, body tightly enveloping the achene; beak 0.1 mm long, red-brown and hyaline at tip, straight at maturity, orifice entire and circular. Achenes dark brown, 1–1.5 mm long, 0.6–0.9 mm wide, sessile or with 0.25 mm stipe, filling the perigynia or at least $\frac{3}{4}$ the length and width. Rachilla absent. Anthers 1.5–2 mm long.

DISTRIBUTION. This is the most geographically restricted of the four subspecies (Figure 3), occurring only along the shores of Lake Huron on the Bruce Peninsula, on islands of the Manitoulin District, Ontario, and on Drummond Island and Thunder Bay Island, Michigan.

HABITAT. Subspecies *convoluta* is associated with alvar communities, characterized by Catling and Brownell (1995) and Stephenson (1983), as areas with sparse vegetation and thin soil over flat limestone or marble substrate. These open alvar communities contain a number of plant species that are calcicolous, often drought resistant, and grow in cracks of outcropped limestone “pavements.”

Subspecies *convoluta* is distinguished by narrow, convolute leaves of the vegetative and flowering shoots, a strongly cespitose habit, and a higher number of flowering culms per plant than other subspecies.

These narrow-leaves plants were first described as a variety of *Carex scirpoidea* by Kükenthal based on specimens collected by Wheeler in 1895 from Thunder Bay Island, Michigan. Unfortunately, Kükenthal’s *Carex* herbarium, presumably including the holotype of *C. scirpoidea* var. *convoluta*, was sent to Berlin (B) and was destroyed during World War II (Stafleu and Cowan 1979). Isotypes of Wheeler’s 1895, Thunder Bay Island, Michigan, collections are available.

REPRESENTATIVE SPECIMENS: **Canada.** ONTARIO: Algoma District, Great Cloche Island, 26 Jul 1956, *Soper & Fleischmann 6633* (CAN); Bruce Co.,

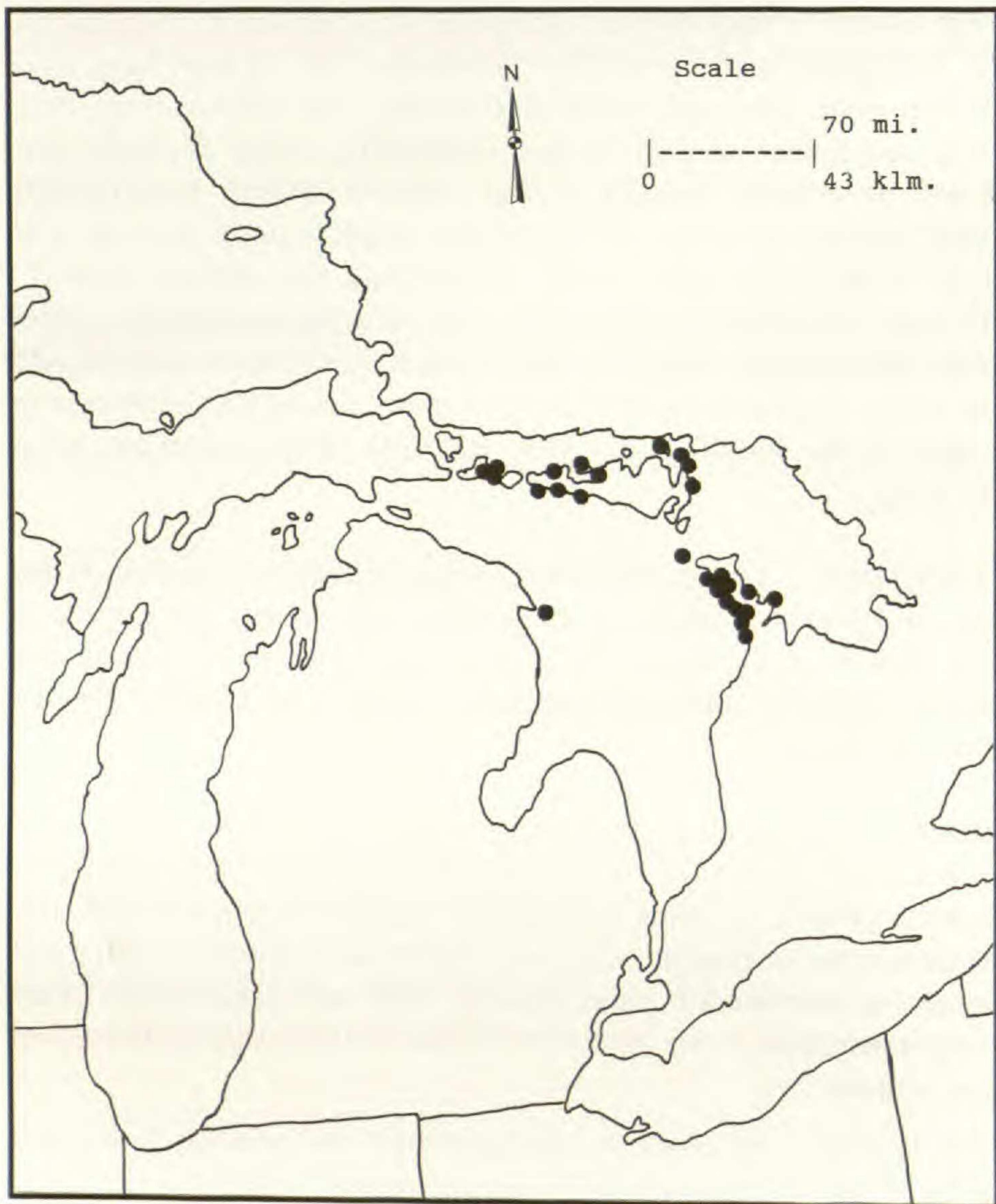


Figure 3. Distribution of *Carex scirpoidea* ssp. *convoluta*.

Cape Croker, MacGregor Harbour, 19 May 1969, *Morton* 2658 (CAN, WAT); Dorcas Bay, 2 Jun 1979, *Webber* s.n. (TRTE), 23 Jun 1971, *Masih & Keal* 579 (TRTE); French Bay, 22 Aug 1898, *Dearness* 2518 (DAO); between Frenchman Bay and Sauble Beach South, 3 Jun 1950, *Soper & Shields* 4538 (CAN, DAO, MO, MT); Howdenvale, 31 Jul 1936, *Watson* 2904 (CU, NY, US); Lion's Head, 11 Jun 1932, *Marie-Victorin, Rousseau & Prat* 45-922 (DAO, GH, MT); Little Pine Tree Harbour, Zinker Island Cove, 30 Jun 1982, *Webber* 4552 (TRTE); Oliphant, 9 Aug 1971, *Montgomery* 3693 (WAT); Red Bay, 9 Jul 1941, *Sargent* 5 (GH); Sauble Beach, 20 Jun 1934, *Taylor & Fernald* s.n. (WIS); Stokes Bay, 26 May 1934, *Krotkov* 8759 (NY, US), 8792 (GH); Barrie Island, May 1979, *Hogg* s.n. (CAN, WAT); Georgian Bay Island National Park, Cove

Island, Bass Bay, 22 Sep 1981, *Bobbette 7403* (WAT); Zinkan Island, 45°04'N, 81°29'W, 15 Jul 1975, *Cuddy & Emalie 1815* (CAN); Manitoulin District, Barrie Island, Rozels Bay, 29 Jul 1985, *Hellquist 15513* (NASC); Green Island Harbour, 20 Jul 1976, *Ringius & Wilson 327* (WAT); Hensly Bay, 26 May 1978, *Morton & Venn 11521* (WAT); La Cloche Peninsula, 20 Aug 1932, *Fassett 14899* (WIS, GH), 11 Jul 1957, *Pease & Bean 26203* (GH); Whitefish River W side Hwy. 68, 3 Jul 1976, *Catling & McIntosh s.n.* (DAO, WIS); Misery Bay, 28 Jul 1972, *MacDonald & White 3593* (CAN); Murphy Point, 14 Jul 1952, *Senn 5974* (DAO, MT, NY, PAC, US, WS); Tamarack Cove, 20 Jul 1932, *Koelz 4206* (MICH, WIS); Tamarack Point, *Grassl 4594* (MICH).

United States. MICHIGAN: Alpena Co., Thunder Bay Island, 18 Aug 1895, *Wheeler s.n.* (BH, CAN, GH, MICH, MIN, MSC, NY, POM, VT); Chippewa Co., Drummond Island, Meade Island, 19 Jun 1979, *Voss 15074* (MICH).

1d. ***Carex scirpoidea* Michx. ssp. *stenochlaena* (Holm) Löve and Löve**, *Taxon* 13: 202. 1964. *C. scirpoidea* Michx. var. *stenochlaena* Holm, *Amer. J. Sci.* IV 18: 20. 1904. *C. stenochlaena* (Holm) Mackenzie, *Bull. Torrey Bot. Club* 35: 269. 1908. TYPE: CANADA. British Columbia: Chilliwack Lake, by a rivulet, 4000 ft., 12 Jul 1901, *Macoun 33728* (LECTOTYPE: CAN 21326! designated herein; ISOLECTOTYPES: CAN! MO! MSC! NY! US!).

Rhizomes short. Culms several per node, arising from shoots of the current year, (lacking any withered persistent leaf bases of the previous year), scabrous toward the apex. Pistillate culms 0.6–1 mm wide at the top, 1.4–2.1 mm wide at base, 24–34 cm tall. Staminate culms 0.5–0.8 mm wide at the top, 2.2–3 mm wide at the base, 14–26 cm tall. Leaf sheaths of the rhizome and the culm base red-brown to brown-black, glabrous, shiny, coriaceous. Leaves of the flowering shoot 3–5, not clustered, adaxial surface glabrous, margins scabrous; in pistillate plants 12.5–25 cm long, 1.4–2.1 mm wide; in staminate plants 14–20 cm long, 1.5–2.4 mm wide. Vegetative leaves 5–6 per shoot; in pistillate plants 10–28 cm long, 1–2.5 mm wide, in staminate plants 19–24 cm long, 1.4–2.5 mm wide; ligules semicircular, 0.8–1.5 mm in height, 1–2.5 mm wide. Inflorescences unisexual, unispicate (occasionally with a single, short lateral spike), drooping on lax culms, mostly clavate, loosely-flowered especially at base; pistillate spikes 25–30 mm long, 3.5–6.5 mm wide; staminate spikes (few seen) 18–25 mm long, 4–5 mm wide. Involucral bract single, foliaceous, shorter than the inflorescence, 4–40 mm long, base inserted on culms 10–33 mm below spike, auriculate. Pistillate scales oblong-lanceolate, 2.4–3.5 mm long, 1–1.5 mm

wide, equal to or shorter than perigynia, apex subacute to acute, red-brown to black, without hyaline margins; central midrib obscure, only slightly raised, red-brown, but lighter in color than rest of scale, extending to the apex; margins ciliate. Staminate scales similar to pistillate, (3.5) 4.5–5 (6) mm long, (0.7) 1–1.4 mm wide. Perigynia lanceolate to oblanceolate, (2.8) 3–4 (5) mm long, 0.9–1.4 (1.6) mm wide, as wide as subtending scale, tapering gradually to beak, with short basal stipe, adaxial surface nerveless or with few short obscure basal nerves, red-brown to black, rarely tan, hirsute with tan to brown hairs, loosely enveloping the achene in upper $\frac{1}{3}$; beak 0.3–0.5 mm long, dark brown and not hyaline, reflexed at maturity, orifice entire and abaxially oblique. Achenes light brown, 1.2–2 mm long, 0.8–1 mm wide, with 0.25–0.50 mm stipe, filling $\frac{1}{2}$ to $\frac{2}{3}$ the length of the perigynia. Rachilla absent. Anthers 3–3.5 mm long.

DISTRIBUTION. This subspecies occurs in the Cascade Mountains in Washington, the Bitterroot Mountains in Montana, the coastal ranges in southern British Columbia, and at a few localities in Alaska and the Yukon (Figure 4).

HABITAT. In the Bitterroot Mountains of Ravalli County, Montana, this subspecies grows on bedrock terraces between 1615–2620 m elevation, especially between 2130–2440 m. In Washington it grows mostly between 1460–2010 m.

This taxon is associated with weakly acidic soils which have high levels of magnesium and low levels of calcium. Edaphic requirements may be an important isolating factor for this subspecies. More detailed studies of habitat requirements and micro-environments are required before one can speculate on the history of this taxon and how it is related to the other subspecies.

Subspecies *stenochlaena* is distinguished by lanceolate perigynia which are greater than 3 mm long, taper gradually to a beak, and are over 2.5 times as long as wide. The pistillate spikes are clavate, loosely flowered at the base, and borne on slender, lax culms which cause the spikes to droop. The pistillate scales are over 3 mm long, subtending hirsute perigynia with tan, yellow, or golden-brown hairs. Both perigynia and pistillate scales are dark brown to black. Beaks are dark and reflexed at maturity, with an oblique mouth.

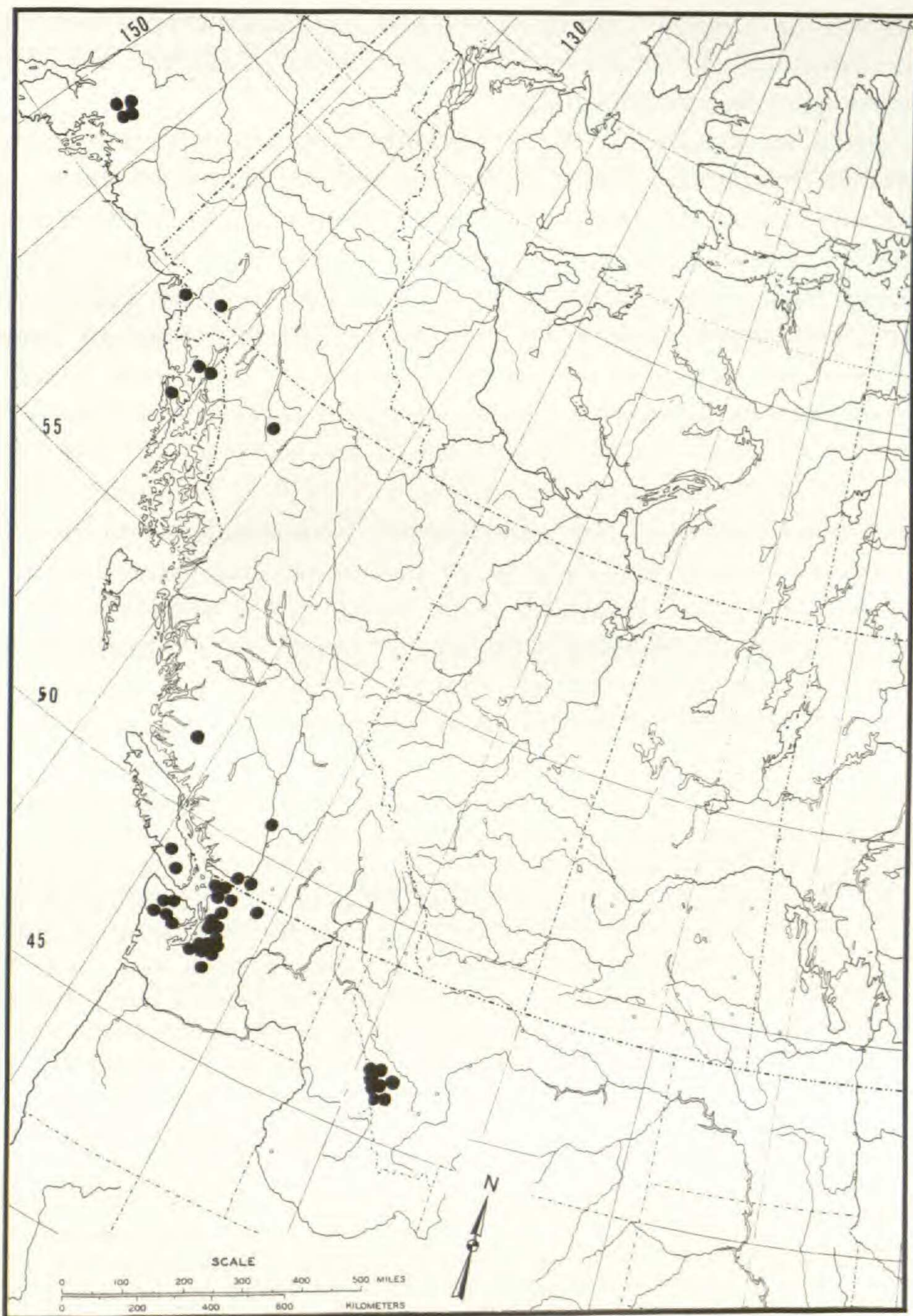


Figure 4. Distribution of *Carex scirpoidea* ssp. *stenochlaena*.

A lectotype, designated herein, has been selected from Macoun's specimens since no specimen was chosen by Holm. The lectotype (CAN 21326) is a Macoun specimen bearing a "Geologic Survey of Canada" label, while others bear "Ex. Herb. Geologic

Survey of Canada" labels. The latter are isolectotypes bearing the same number as the lectotype, but having a slightly different wording of the locality data.

Some geographically based variation is present within this subspecies. Specimens from Washington and the Bitterroot Range in Ravalli County, Montana have the longest perigynia, often reaching 4.3 mm, and are the most distinct from ssp. *scirpoidea*. Specimens from Alaska, northern British Columbia and the Yukon exhibit tendencies towards ssp. *scirpoidea*. Fifteen percent of these plants have perigynia just under 3 mm long (high end of ssp. *scirpoidea* range) and perigynia length-to-width ratios over 2.5 (unlike those of ssp. *scirpoidea* which are less than 2.5 times as long as wide); they lack the clavate, loosely flowered spikes characteristic of plants of ssp. *stenochlaena* in Washington and Ravalli County, Montana. The intergradation observed in plants from British Columbia and elsewhere might be the result of hybridization between ssp. *stenochlaena* and ssp. *scirpoidea* at localities where their ranges overlap. For this reason, subspecies *stenochlaena* is recognized at the subspecific level, rather than the specific level.

REPRESENTATIVE SPECIMENS: **Canada.** BRITISH COLUMBIA: Bluster Mt., Marble Mts., 14 Jul 1938, *Thompson & Thompson 455* (CAS, DAO, F, GH, MO, NY, US, WTU); Chilliwack Valley, 49°10'N, 121°–122°25'W, 12 Jul 1901, *Macoun 33728* (CAN, MO, MSC, NY, US); Katherine Lake, 57°26'N, 126°48'W, 25 Jul 1977, *Gillett & Boudreau 17441* (CAN); Kinbasket, Big Bend Hwy., Sullivan River, 1 Aug 1947, *Eastman 15994* (DAO, UBC); Maroon Mt., 54°47'N, 128°40'W, 18 Sep 1977, *Foster 9* (UBC); McGillivray Creek, Cascade Range, 10 Aug 1916, *Macoun 97965* (CAN, GH, US); Moose River, 15–17 Jul 1911, *Hollister 43* (NY, US); Mt. Assiniboine Park, Lake Magog, 16 Jul 1937, *Rose 37550* (CAS, UC); Mt. Chelam, 15 Aug 1901, *Anderson s.n.* (MO); Noaxe Lake, 4 Aug 1957, *Brink s.n.* (DAO, OSU, UBC); Ellis Point & Mercer Point, W of Skidegate channel, Graham Island, *Calder & Savile 22870* (DAO, DS, GH, NY, RSA, UC, WS, WTU); Vancouver Island, Marble River, N of Alice Lake, 13 Jul 1964, *Hett & Armstrong 403* (DAO); Marble Lake, near Jeune Landing, 13 Jul 1964, *Hett & Armstrong 399* (DAO); Mt. Klitsa, 22 Jul 1971, *Pojar 177* (UBC); YUKON TERRITORY: Alsek Valley, ca. 8 mi. W of Mackintosh, 5 Jul 1957, *Schofield & Crum 7559* (DS, UBC); Canol Road, mile 132, Lower Lapie River, 26 Jun 1944, *Porsild & Breitung s.n.* (NY, US), 22 Jun 1944, *Porsild & Breitung 11981* (CAN); Canol Road, Mt. Sheldon, 3 Aug 1944, *Porsild & Breitung 11708* (CAN), *11703* (GH); Kluane Lake, near Rusty Glacier, W of Burwash Landing, 61°16'N, 140°15'W, 9 Jul 1968, *Murray 1671* (CAN); Mackintosh, mile 1002, Alaska Hwy., Alsek Valley Road, 4–5 Jul 1957, *Schofield & Crum 7520, 7560, 7561* (CAN).

United States. ALASKA: Charlie River, 64°50'N, 143°40'W, 30 Aug 1956, *Argus 872* (RM, SASK); Chugach Range, Tazalina Glacier, 61°45'N, 146°30'W,

19 Jul 1957, *Viereck 2194* (CAN); Juneau, 10 Jul 1917, *Anderson 365* (NY); Mt. McKinley National Park, 2 mi. N of N entrance, 29 Jul 1967, *Hermann 21517* (MICH, NY); Wonder Lake, *Argus 660* (SASK); Mt. Hayes, *Palmer 606* (US); Mt. Roberts, Juneau, 26 Jun 1925, *Anderson 2A233* (GH); Yes Bay, 16 Jul 1895, *Howell 1705* (CAS, MSC, NY, US); MONTANA: Ravalli Co., Bitterroot National Forest, Bailey Lake, 22 Aug 1985, *Dunlop & Orlando 2272* (NHA); Bitterroot-Selway Divide above Baily Lake, 12 Jul 1969, *Lackschewitz 1344* (NY, RM); Chaffin Lake Basin, Chaffin Peak, 30 Aug 1971, *Lackschewitz 3397* (MONTU); Sheafman Lake, 17 Aug 1979, *Lackschewitz 2317* (MONTU); St. Joseph's Peak, 31 Jul 1969, *Lackschewitz & Fageraas 1631* (MONTU); Tin Cup Lake, 19 Jun 1971, *Lackschewitz 2727* (MONTU); Trappers Peak, 14 Aug 1946, *Hitchcock & Muhlick 15381* (CAS, NY, WTU); White Mt., 11 Aug 1970, *Lackschewitz & Smith 2277* (MONTU); WASHINGTON: Chelan Co., Crown Point, Holden-Lyman Lake Trail, 20 Aug 1956, *Raven 10176* (CAS); Ingalls Peak, 20 Jul 1925, *St. John & Thayer 7239* (WS); Mt. Stuart, 23 Jul 1933, *Thompson 9580* (DS, GH, MO, NY, RSA, UC, US, WTU); Skagit Pass, 24 Aug 1892, *Lake & Hull 408* (WS); Clallam Co., Mt. Angles, Starvation Flats, 17 Jul 1931, *Thompson 7419* (PH, WTU); Olympic Mt., Aug 1895, *Piper 2243* (BH, GH, WS); Jefferson Co., Mt. Anderson, 28 Jul 1936, *Meyer 686* (MO, WS); King Co., Denny Creek, 19 Aug 1936, *Thompson 13684* (CAS, MO, NY, PH, WS, WTU); Guy Peak, Snoqualmie Pass, 7 Aug 1933, *Thompson 9690* (NY, WTU); Kittitas Co., Beverly Creek Trail, T22N R15E ca. S1, 17 Aug 1985, *Dunlop & Orlando 2241* (NHA); Fish Lake, 17 Jun 1934, *Thompson 10663-4* (CAS, DS, GH, NY, POM, US, WTU, UWT); Okanogan Co., Hart's Pass, ca. 20 mi. E of Diablo, 11 Jul 1971, *Douglas 2866* (ALTA); Horse Shoe Basin, Sep 1897, *Elmer 684* (MIN, MO, NY, POM, US, VT, WS); Snohomish Co., Mt. Pugh, 18 Aug 1938, *Thompson 14340* (CAS, GH, WTU); Whatcom Co., Crater Mt., 20 Aug 1971, *Naas 1240* (RM); Twin Lakes, Jackson Mt., 7 Sep 1927, *St. John 8941* (WS, RM); Mt. Shuksan, ca. 22 mi. N of Rockport, 13 Jul 1969, *Douglas 1417* (RM).

2. ***Carex curatorum*** Stacey, *Leafl. W. Bot.* 2: 13. 1937. *C. scirpoidea* var. *curatorum* (Stacey) Cronquist, *Intermountain Flora* 6: 113. 1977. TYPE: U.S.A. Arizona: Grand Canyon National Park, Kaibab Trail to Roaring Springs, 23 Jun 1933, *Eastwood & Howell 1100* (LECTOTYPE: CAS 204972! designated herein).

Carex haysii Welsh, *Mem. N. Y. Bot. Gard.* 64: 124. 1990. TYPE: U.S.A. Utah: Washington Co., Zion Canyon, Lower Emerald Pool, Springdale Sandstone, hanging garden, sandy bank and cliff face, ca. 4300 ft. T41S R10W S9, 5 Jun 1989, *Welsh, Clark & Hays 24335* (HOLOTYPE: BRY; ISOTYPES: CAS, MICH!, NY!, POM, RM, UT).

Rhizomes short and forming mats. Culms one to several per node, arising from current year shoots (lacking the withered persistent leaf bases of the previous year), strongly scabrous the full length of culm. Pistillate culms 0.4–1.2 mm wide at the top, 0.7–3.5 mm wide at the base, (23) 35–91 cm tall. Staminate culms

0.5–1 mm wide at the top, 0.9–4.5 mm wide at the base, 20–74 cm tall. Leaf sheaths of the rhizome and culm bases light brown to purple-black, glabrous, dull, coriaceous. Leaves of the flowering shoots 2–6, arising from the base and not clustered, adaxial surface sparsely pilose especially along median adaxial groove and veins, margins strongly scabrous; in pistillate plants 12–57 cm long, 1.5–2.3 mm wide; in staminate plants 12–25 cm long and 1.2–3.1 mm wide. Vegetative leaves 4–11 per shoot; in pistillate plants 14–55 (79) cm long, 1.1–2.3 mm wide; in staminate plants 18–55 cm long, 1.2–1.9 mm wide; ligules triangular, 1.4–4.2 (5) mm in height, 1.1–2.3 mm wide. Inflorescences unisexual (rarely bisexual), not strictly unispicate, (occasionally with 1–2 short lateral spikes of the same sex in the axil of the involucrel bract or subtending the terminal spike), erect or drooping on lax culms, linear, loosely to densely flowered; pistillate spikes 17–43 mm long, 2.5–5 mm wide, staminate spikes 13–37 mm long, 2–5 mm wide. Involucrel bract usually present, usually single, foliaceous or scale-like, shorter than or equal to length of the inflorescence, 6–11 cm long, base inserted 5–75 mm below spike, auriculate. Pistillate scales oblong-lanceolate, 2–3.5 mm long, 0.7–1.9 mm wide, half as long as to equaling the perigynia, apically acute, red-brown with narrow to broad hyaline margins; central midrib narrow, extending to apex, occasionally prolonged into a short awn; margins entire, sometimes ciliate. Staminate scales similar to pistillate, 3.5–4.3 mm long, 1–1.3 mm wide. Perigynia obovate to ovate, 2–3 (4) mm long, 1.5–1.8 mm wide, wider than subtending scale, tapering gradually or abruptly contracted to a beak, with few obscure nerves on the adaxial surface over the achene, marginal nerves evident, pale green to tawny becoming red-brown towards apex, hirsute with white hairs; body not tightly enveloping the achene; beak 0.1–0.5 mm long, red-brown and hyaline at tip, straight at maturity, orifice entire and adaxially oblique. Achenes dark brown, 1.2–2 mm long, 0.8–1.2 mm wide, stipe 0.25 mm, filling only $\frac{1}{3}$ – $\frac{1}{2}$ the length of the perigynia and $\frac{1}{3}$ the width such that the perigynia sides are compressed and contracted at the base. Rachilla often present. Anthers 1.7–2.4 mm long.

DISTRIBUTION. *Carex curatorum* is limited to southern Utah and adjacent northern Arizona (Figure 5), especially along the Colorado and San Juan Rivers and their tributaries.

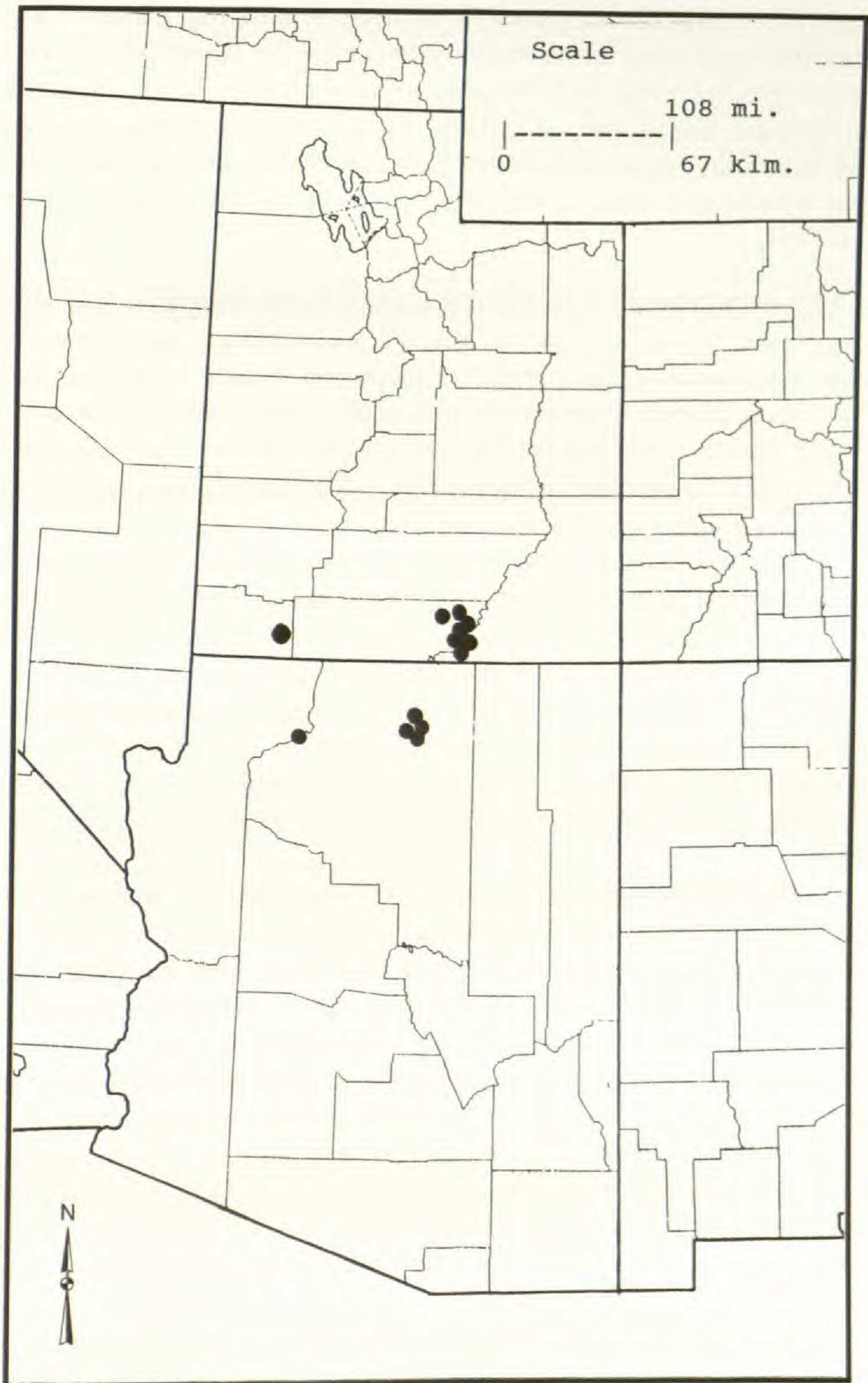


Figure 5. Distribution of *Carex curatorum*.

HABITAT. This taxon grows in riparian or hanging garden communities, and may have been represented by more populations before the damming and flooding of the Colorado River. It occurs on Navajo Sandstone, described as a crossbed of fine-grained sandstone and gray limestone (Lohman 1975), and on the Kayenta Formation, both of which are widespread substrata in southern Utah.

Carex curatorum is a distinct southwestern endemic. It is distinguished by sparsely pilose adaxial leaf surfaces, most obvious with the scanning electron microscope but visible with a dissection microscope. Achenes are not tightly enveloped by the perigynia and the pistillate scales are mostly shorter than the perigynia. The scales and perigynia are characteristically lighter in color than other taxa of section *Scirpinae*.

Plants flower from April to May. Upon maturity, the perigynia and enclosed achenes disarticulate from the spikes, and are readily dispersed, unlike *Carex scirpoidea* which retains achenes and perigynia sometimes until the next growing season. Maximum culm height is greater than that of *C. scirpoidea*, and the achene fills only a small portion of the perigynium. The unique achene micromorphology of *C. curatorum* and its sparsely pilose adaxial leaf surfaces segregate it from all other members of section *Scirpinae*.

In naming this species Stacey (1937) selected the epithet "curatorum" to honor Alice Eastwood and J. T. Howell, curators at the California Academy of Sciences, and the collectors of the type specimens. Stacey (1937) designated both a staminate and pistillate plant, on separate sheets and with different collection numbers, to serve as types. The pistillate specimen (*Eastwood & Howell 1100* CAS 204973), is selected herein to serve as the lectotype, since it possesses the diagnostic features of this taxon. The staminate specimen (*Eastwood & Howell 1101* CAS 204973) and two other specimens (*Eastwood & Howell 1045* CAS, *1089* CAS) collected along with the type remain important original material from the type locality.

Carex haysii Welsh, described in 1990, is treated here as a synonym since all the characters that are said to distinguish it overlap with *C. curatorum* except for perigynium length. However, on many specimens, the longest perigynia of *C. haysii* lacked fully formed achenes.

REPRESENTATIVE SPECIMENS: **United States.** ARIZONA: Coconino Co., Grand Canyon National Park, Kaibab Trail to Roaring Springs, 22 Sep 1938, *Eastwood & Howell 7073* (CAS, F, MICH, MT, NY, POM, UC, US, WTU); Grand Canyon National Park, False President Harding Rapids, mile 43, 17 Mar 1974, *Karpiscak & Theroux 941* (ARIZ); Colorado River, Buck Farm Canyon, 40.75 mi. below Lees Ferry, ½ mi. above river, 29 Apr 1970, *Holmgren, Holmgren & Ross 15481* (COLO); Mohave Co., Grand Canyon National Monument, Toroweap Pt., Saddle Horse Springs, 13 Jun 1941, *Cottam 8652* (COLO, UT); UTAH: Kane Co., confluence of San Juan & Colorado Rivers, on San Juan, ca. ¼ mi. above second hanging garden on W in side-canyon, 9 Jun 1972, *Atwood 4094* (BRY); Glen Canyon National Recreation Area, Lake Powell, vicinity North Escalante, ca. 3800 ft., T40S R9E S36, 28 May 1983, *Welsh 22113* (BRY, NY); Long Canyon, Waterpocket Fold, T39S R9E S1, 24 May 1984, *Welsh 22850* (BRY); Coyote Creek Canyon, near Jacob Hamblin Arch, T38S R8E, 29 Jul 1985, *Dunlop & Orlando 2087* (NHA); Glen Canyon Nat. Rec. Area, Cow Canyon, Waterpocket Fold, T38S R9E S36, 26 Jul 1983, *Welsh, Welsh & Chatterley 22350* (BRY); San Juan Co., Lake Powell, Double Cove Garden, T40S R9E S25, 3800 ft., 1 Jul 1983, *Welsh 22322* (BYU, UT); Lake Powell, Ribbon Canyon, canyon sides and hanging gardens, T41S R10E S5, 25 Apr 1983, *Welsh 21730* (BRY); Washington Co., Zion Canyon, Lower Emerald Pool, Springdale Sandstone, hanging garden, sandy bank and cliff face, ca. 4300 ft., T41S R10W S9, 5 Jun 1989, *Welsh, Clark & Hays 24335* (BRY, CAS, NY, POM, RM UT); Kayenta Formation, ca. 6000 ft., Kolob Section, hanging garden below Kolob Arch, ca. 5 mi. SE of Kolob Canyon visitor center, T39S R12W S1, 25 May 1989, *Higgins 18499* (BRY, CAS, NY, RM, UT, UTC); Zion Canyon, Weeping Rock, T41S R10W S2, ca. 4300 ft., 9 Jul 1988, *Welsh, Clark & Charlesworth 24059b* (BRY); Zion Canyon, Lower Emerald Pool, Springdale Sandstone, hanging garden, ca. 4300 ft., T41S R10W S9, 2 May 1989, *Welsh & Clark 24233* (BRY).

EXCLUDED TAXA

- Carex gigas* (Holm) Mackenzie, Bull. Torrey Bot. Club 35: 268. 1908. *Carex scirpoidea* var. *gigas* Holm, Amer. J. Sci. IV 18: 20. 1904. TYPE: U.S.A. California: Siskiyou County, Mt. Eddy (not known).
- Carex scabriuscula* Mackenzie, Bull. Torrey Bot. Club 35: 268. 1908. TYPE: U.S.A. Wet meadow in the Cascade Mountains, 30 Jun 1902, *Cusick 2849* (HOLOTYPE: NY!; ISOTYPES: CU!, DS!, ORE!, OSC!, POM!, UC!, WS!).

The taxonomic status of *Carex gigas* and *C. scabriuscula*, serpentine endemics in California and Oregon, remains problematic. These two taxa are excluded from section *Scirpinae* because they are rarely unispicate, often not dioecious, and do not possess the pubescence of the perigynia characteristic of the section. Exclu-

sion is further supported by evidence from chromosome numbers, leaf surface features, and ecology (Dunlop 1990).

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LITERATURE CITED

- BAILEY, L. H. 1887. A preliminary synopsis of North American Carices. Proc. Amer. Acad. Arts 22: 1-157.
- CATLING, P. M. AND V. R. BROWNELL. 1995. A review of the alvars of the Great Lakes region: Distribution, floristic composition, biogeography and protection. Canad. Field-Naturalist 109: 143-171.
- CRINS, W. J. AND P. W. BALL. 1989. Taxonomy of the *Carex flava* complex (Cyperaceae) in North America and northern Eurasia. II. Taxonomic treatment. Canad. J. Bot. 67: 1048-1065.
- DUNLOP, D. A. 1990. The biosystematics of *Carex* section *Scirpinae* (Cyperaceae). Ph.D. dissertation, Univ. New Hampshire, Durham, NH.
- . 1997. Taxonomic changes in *Carex* (section *Scirpinae*, Cyperaceae). Novon 7: 355-356.
- HERMANN, F. J. 1957. New carices from the Canadian Rocky Mountains. Leaf. W. Bot. 8: 109-114.
- HOLM, T. 1904. Studies in the Cyperaceae. XXII. The Cyperaceae of the Chilliwack Valley, British Columbia. Amer. J. Bot. Ser. 4, 18: 12-22.
- KRECHETOWICH, V. 1935. *Carex*. In: V. L. Komarov, ed., Flora of the USSR

- 3: 111–464. (English translation by N. Landau, Smithsonian Institute and the National Science Foundation, 1964. 3: 86–369).
- KÜKENTHAL, G. 1909. Cyperaceae—Caricoideae. *Das Pflanzenreich* 4(20): 1–824.
- LOHMAN, S. W. 1975. The Geologic Story of Arches National Park. U.S. Dept. Interior, Geologic Survey Bulletin 1393.
- MACKENZIE, K. K. 1908. Notes on *Carex*. *Bull. Torrey Bot. Club* 35: 266–270.
- . 1935. Cyperaceae—Cariceae. *N. Amer. Fl.* 18: 1–478.
- MICHAUX, A. 1803. *Flora Boreali-Americana*. Vol. II. Facsimile Edition, 1974. Hafner Press, New York.
- NELMES, E. 1951. Facts and speculations on phylogeny in the tribe Cariceae of the Cyperaceae. I. General considerations. *Kew Bull.* 1951: 427–436.
- O'NEILL, H. AND M. DUMAN. 1941. A new species of *Carex* and some notes on this genus in arctic Canada. *Rhodora* 43: 413–425.
- PAX, F. A. 1887. *Carex*. In: A. Engler and K. A. Prantl, eds., *Nat. Pflanzenfamilien* 2(2). W. Englemann, Leipzig.
- REZNICEK, A. A. 1990. Evolution in sedges (*Carex*, Cyperaceae). *Canad. J. Bot.* 68: 1409–1432.
- RYDBERG, P. A. 1900. Catalogue of the Flora of Montana and the Yellowstone National Park. *Mem. New York Bot. Gard.* 1: 78.
- STACEY, J. W. 1937. Notes on *Carex* VII. *Leafl. W. Bot.* 2: 13–15.
- STAFLEU, F. A. AND R. S. COWAN. 1979. *Taxonomic Literature*, Vol. II. *H-Le. Regnum Veg.* Vol. 98. Bohn, Scheltema & Holkema, Utrecht.
- STANDLEY, L. A. 1985. Systematics of the Acutae group of *Carex* (Cyperaceae) in the Pacific Northwest. *Syst. Bot. Monogr.* 7: 1–106.
- STEPHENSON, S. N. 1983. Maxton Plains, Prairie refugia of Drummond Island, Chippewa County, Michigan, pp. 56–60. In: Richard Brewer, ed., *Proceedings of the Eighth North American Prairie Conference*. Kalamazoo, MI.
- TUCKERMAN, E. 1843. *Enumeratio Methodica Caricum Quarundam*. Isaacus Riggs, Schenectady, NY.
- WELSH, S. L. 1990. Utah novelties in *Carex* (Cyperaceae) and *Lomatium* (Umbelliferae). *Mem. New York Bot. Gard.* 64: 124–128.